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University Students and Sustainability. Part 1: Attitudes, Perceptions, and Habits

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Abstract

Increased understanding amongst scientists and the general public about anthropogenic impacts in general, and climate change in particular, behooves us as educators to adjust our courses and curricula. “Sustainability” and “green” topics are increasingly being discussed and incorporated, but this should be done with deliberation. We undertook this study to understand attitudes, perceptions, and habits of the student body at Iowa State University, with a focus on environmental knowledge and behaviors. Overall, we found that, regardless of demographic, students appear to be interested in environmental topics, reducing their footprint, and improving the environment overall. But, they did not necessarily want to pay more, nor did they fully embrace personal responsibility.

Keywords

education, knowledge, behavior, responsibility, sustainability, sustainable thinking

Disciplines

Educational Assessment, Evaluation, and Research | Environmental Studies

Comments

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University Students and Sustainability. Part 1: Attitudes, Perceptions, and Habits

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Abstract: Increased understanding amongst scientists and the general public about anthropogenic impacts in general, and climate change in particular, behooves us as educators to adjust our courses and curricula. “Sustainability” and “green” topics are increasingly being discussed and incorporated, but this should be done with deliberation. We undertook this study to understand attitudes, perceptions, and habits of the student body at Iowa State University, with a focus on environmental knowledge and behaviors. Overall, we found that, regardless of demographic, students appear to be interested in environmental topics, reducing their footprint, and improving the environment overall. But, they did not necessarily want to pay more, nor did they fully embrace personal responsibility.

Keywords: education, knowledge, behavior, responsibility, sustainability, sustainable thinking

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Abstract

We undertook this study to understand the attitudes, perceptions, and habits of the student body at Iowa State University regarding the environment. We sought to understand their environmental knowledge and behaviors. Overall, we found that, regardless of demographic, students appear to be interested in environmental topics, reducing their footprint, and improving the environment overall, but they did not necessarily want to pay more, nor did they fully embrace personal responsibility.

Introduction

Many governments have instituted some degree of either climate mitigation or pollution reduction policies to address climate change. The United States and China, the two leading nations in global emissions, recently announced that both the U.S. and China would commit to substantial reductions in their greenhouse gas emissions by 2030 (Davenport, 2014). However, as Mike Hulme (date), contributor to the United Nations Intergovernmental Panel on Climate Change (IPCC) writes in *Why We Disagree About Climate Change*, climate change is viewed as “mega-problem” that leads us to believe we need a “mega-solution,” and that kind of thinking has lead us astray (Hulme 2009). To effectively combat climate change, many solutions are must be enacted communally and locally, connecting to create vast social, cultural, and ecological change on a global scale.

Climate change is just one of many environmental issues in which humans play a causative role and are significantly impacted. Others include pollution, the increasing scarcity of water, and food insecurity – some of which can also be tied to climate change. It is true that many governments, companies, and NGOs are now working to address, mitigate, and even adapt to climate change.

Moreover, understanding of anthropogenic effects, discussions amongst citizens, governments, and companies, and programs to reduce human impacts on the environment are not only seen in the domain of policy makers and companies, but they are increasingly being infused into university activities and curricula as well. More than 21 million students were enrolled in U.S. institutions of higher education in 2013 (U.S. Department of Education, 2013). Many universities are taking steps to increase their efforts and not only become more sustainable themselves, but also to increase student knowledge about environmental impacts. Ohio State University, for example, has instituted a sustainability learning community that allows students to be actively involved in sustainability events across campus and to learn about sustainability with faculty members and partnering businesses (Ohio State University, 2014). The University of Maryland has an initiative termed “PALS”, or Partnership for Action Learning in Sustainability, which works with local government agencies to assist with implementing sustainability efforts (National Center for Smart Growth Research and Education, 2014).

Many of these efforts have been catalogued: the College Sustainability Report Card evaluated 322 schools in the U.S. in 2011, and determined that 75% of the participating schools had full-time staff dedicated to sustainability initiatives and education, over half of them have made

commitments to achieving carbon neutrality, and 52% have on-site wind, solar, or geothermal energy production (College Sustainability Report Card, 2011).

However, how much do college and university efforts really impact student attitudes and behaviors? How much of the student population can be reached at each school? Some studies have attempted to answer these questions, and to determine how students perceive sustainability. For example, Richard and Adams (2011) compared views of campus sustainability by students at public universities in Alabama and Hawaii. Hawaii has been denoted as the fourth greenest state in the U.S., whereas Alabama the 48th; their study attempted to ascertain whether or not there was a link between the overall rank of the state and the perceptions of college students. Their study found that respondents from both states were concerned about waste and pollution, and were quite similar on their views about who is responsible for sustainability and the environment. However, a large proportion of students from Hawaii expressed willingness to participate in sustainable practices, whereas Alabama students were more reluctant (Richard and Adams, 2011). Other studies have found similar results. Overall, it appears that today's students understand that there is a need for improved sustainability and waste control, and the need to reduce environmental impacts, but discrepancies arise regarding who should take responsibility for these actions, and how sustainable concepts should be implemented.

What about students in the Midwest? Iowa State University, the authors' home institution, has also made commitments to improve its environmental footprint. This effort spans operations, research, education, and outreach. The Iowa Board of Regents (the governing board for the state universities in Iowa) has approved a sustainability plan for the university, which guides the university's sustainability policies. Included in this plan, for example, is the requirement that all new buildings and major renovations must meet or exceed the U.S. Green Building Council's guidelines for silver level LEED certification (Board of Regents, 2009). The university currently has six LEED-certified buildings with eight additional projects in progress. The combined energy portfolio of the university must include at least 10% from renewable sources. The university must also encourage recycling on campus, and will promote reuse, repurposing, and recycling of surplus items from laboratories, offices, and classrooms. The university has been reducing emissions in its campus vehicle fleet through the use of E85 and biodiesel fuels, and has been increasing the number of flex fuel, hybrid, and electric vehicles in the vehicle pool (Board of Regents, 2009). Recently, the university installed a 100-kW wind turbine, and it also purchases electricity from a wind farm, both of which produced ~9% of the university's electricity in 2013 (Iowa State University Utility Services, 2014a). Just this past year, ISU installed solar panels for research and data collection on solar viability, and due to student motivation and innovation, brought multiple disciplines on campus together to collude in creating a campus-wide bike share program (ISU Relations office, 2016; ISU College of Engineering, 2015).

In addition, Iowa State University has developed an Energy Dashboard, which allows anyone with a web browser to see real-time energy use (and historic use) for any building on campus, as well as the university as a whole (Iowa State University Utility Services, 2014b). It depicts, both in real time and historical (weekly and yearly), the total amount of energy being used in most buildings on campus, and in doing so allows users to dynamically view the source of a building's

electricity, whether the source is provided by the Iowa State power plant, is purchased from the Ames power plant, or from the wind farm north of Ames.

As faculty on this campus who work in Environmental Studies and Sustainability issues, we wanted to know: do the students know about these efforts? Do these efforts toward reducing ISU's environmental footprint filter down to the individual student as well? If so, how is the individual student impacted? How can the university provide more information about its sustainability efforts? What are the conservation practices of students? How could the university provide more information and training regarding environmental impacts? What additional practices would students like the university to implement so that the university could become even more sustainable, or help students live more "green" lives? Our study aimed to answer these questions.

Methods

After approval by the Iowa State University (ISU) Institutional Review Board, an online survey was emailed to all undergraduate ($n = 28,893$) and graduate students ($n = 4,950$) at ISU using the Qualtrics survey system. A questionnaire was developed which contained 43 close-ended and 35 open-ended questions, 78 questions total (see Appendix for the survey instrument which was distributed to the students). The close-ended questions were provided to obtain numerical data about the students and their perceptions, whereas the open-ended questions allowed them to elaborate on their answers. Broadly, the survey encompassed four main categories: 1) demographics; 2) personal attitudes, perceptions, and habits; 3) what they knew (or think they knew) about environmental issues; 4) what ISU could do to help them learn more about sustainability and to improve their personal environmental footprints.

At the outset, we fully understood that students receive many university-based and other emails and types of communications on a daily basis, so *a priori* our expectations for a high response rate were low. Our initial emailed request for participation was followed up with three reminder emails (one per week), so overall the survey was available for completion for a duration of four weeks. As expected, the response rate was fairly low. We recognize that this is a limitation of the study, and it may be difficult to generalize for all students at this university, but we must emphasize that, at least in this exploratory phase of our research, our results were quite revealing. Lessons learned from this study will help us develop a more targeted survey in the future.

A total of 1,226 students completed (or substantially completed) the survey instrument, which equated to an effective response rate of approximately 3.5% of all ISU students. Of those respondents, 848 students were enrolled as undergraduates, while 298 were graduate students. Of the total respondents, 521 were male (45%), and 624 (54%) were female.

All numerical results were statistically analyzed using Microsoft Excel, whereas the open-ended questions were summarized according to theme. The first two portions of our survey will be discussed in this paper; the other two segments are the subject of another article currently under development (Rosentrater and Burke). A third article analyzing student responses to questions that asked them to reflect on their personal contributions to environmental damage and any

actions they take to mitigate those impacts is forthcoming from *Climate Change: Impacts and Responses* (Burke and Rosentrater, 2017).

Results and Discussion

1) Demographics

Looking at an overview of the students who responded to the survey (Figure 1) is quite enlightening. Out of the 1126 respondents, 1134 majors were reported (due to double majoring by a handful of the students). The colleges with the highest responses were Agriculture and Life Sciences, and Engineering. Liberal Arts and Sciences also had a fairly large response to the survey. Chemical and Mechanical Engineering individually were the highest reporting majors. In fact, Mechanical Engineering is the largest major at ISU by student population, while Chemical Engineering is also one of the largest majors within the College of Engineering. Further, it should be noted that there were several majors that had some relationship with environmental issues (e.g., Agronomy, Biology, and Environmental Science all had high rates of response). Perhaps this was due, at least in part, to inherent interest that students in these majors may have had in the issues covered by this survey. Additionally, 396 minors were reported for the 1126 respondents (35% of respondents). The highest reported minors were Agronomy, Spanish, and Sustainability – which again, may explain participating in the survey.

When this survey was administered, males comprised 56% of the ISU population whereas females accounted for 44% of the overall student population (Iowa State University Office of the Registrar, 2014a). The university-wide male-to-female ratio was inverted, however, vis-à-vis respondents to our survey. The higher level of female respondents may, in fact, impact our survey results – in favor of belief that climate change is being caused by humans. This trend can also be seen in recent polls that found approximately 60% of U.S. women believe that climate change is human-caused compared to only ~40% of U.S. men (Saad, 2014). At the time of survey distribution, graduate students made up only 14.6% while undergraduates accounted for 85.4% of the overall student population (Iowa State University Office of the Registrar, 2014b). Because this survey had a much higher graduate student representation compared to their actual proportion of the student body, the survey results may be impacted due to graduate students possessing knowledge acquired elsewhere or through additional experience. We had no way to gauge these impacts, however.

At the time of the survey, 21.5% of ISU students lived in campus residence halls (Iowa State University Department of Residence, 2014). This level was almost exactly the same percentage (21%) of respondents who indicated that they lived in residence halls in the survey. Additionally, 56% of respondents reported that they lived in apartments (either within the Department of Residence or external to the university), while 22% of respondents indicated that they lived off campus but not in an apartment (which was most likely in a house or other arrangement).

In 2014 Iowa residents comprised 58.8% of all students at ISU, whereas non-Iowa students from the United States made up 29.6% of students, and international students were 11.6% of the student population (Iowa State University Office of the Registrar, 2014a). The respondents to

this survey mirrored this distribution: 56% of respondents were from Iowa; 36% of respondents were from the U.S. but from outside Iowa; 8% were from outside the U.S.

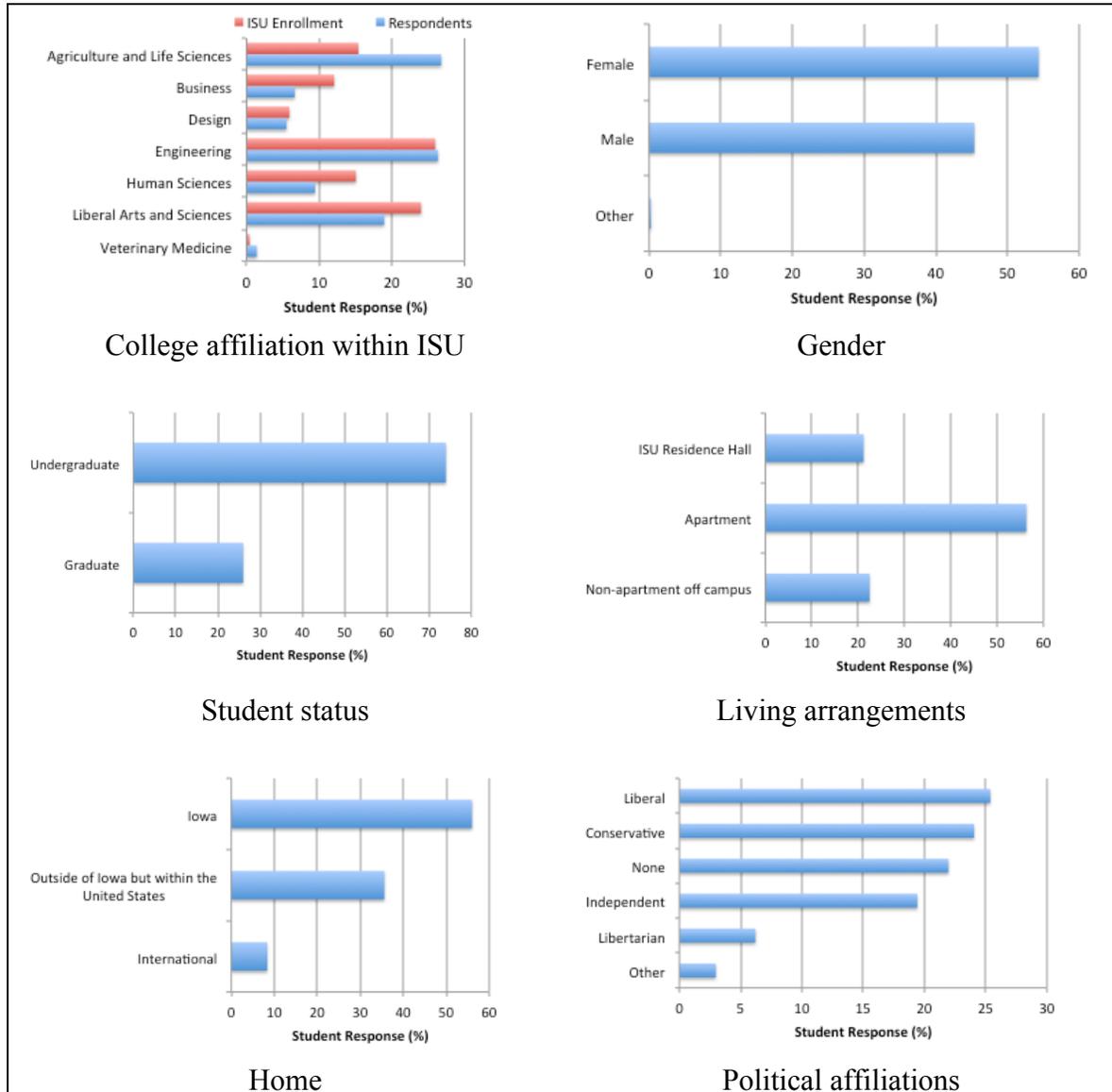


Figure 1. Demographics of survey respondents.

Shortly after the close of the online survey, the March 6, 2015, Gallup poll on political party affiliation indicated that 27% of their respondents identified themselves as Republican, 28% identified as Democrat, while 44% identified as Independent (Gallup, 2015). Respondents to our survey were somewhat similar to that reported by Gallup: 24% Republican vs. 25% Democrat. The rest of our responses were somewhat different from the Gallup results; 19% identified as Independent, 6% as Libertarian, 3% as Other, and 22% as None. Our results were likely more diverse because we included Libertarian, Other, and None as categories, whereas the Gallup poll

did not. Thus, fewer of our respondents identified as Independent, but over one-fifth of them indicated that they did not identify with any particular political affiliation.

2) Attitudes, Perceptions, and Habits

A large portion of our survey (20 questions) centered on attitudes, perceptions, and habits of the students. Some of their numerical responses are summarized in Figure 2. As shown, 42% of the 1126 students indicated that they believed that climate change was happening; 2% of all respondents did not believe in climate change; 56% of students did not answer this question. We speculate that perhaps the majority were unsure and so chose not to answer the question. Therefore, considering those who did respond, the majority (95.2%) did believe that climate change was real, while only 4.8% did not. A recent study by the Pew Research Center indicated that approximately 61% of Americans believe that the climate is changing, and that percent is relatively stable across generations (Motel, 2014). Why did our student body respond at a higher level? Hopefully it is because they are learning about these issues in school, perhaps in high school and/or at ISU. And, if the majority students understand that the climate is changing and that it has an impact on their lives, hopefully they will be more likely to change their own personal behaviors.

What did the students think was causing the climate to change? As shown in Figure 2, 45% of the students responded that humans were responsible; 35% that natural processes were responsible; 77% that it was a combination; 2% that climate change was not actually happening.

The students obtained their information about the environment and climate change from a variety of sources. In fact, no single source dominated. As shown in Figure 2, traditional news media, Internet sites, classes, and family/friends were the primary sources of information for the students. Ironically, both “my own opinion/experience” and government reports were chosen by 30% of the students. Apart from traditional television news, other news sources that were frequently listed included the New York Times, National Geographic, and the Huffington Post. Additionally, both the Daily Show with Jon Stewart and the Colbert Report were listed multiple times. There were a wide variety of responses listed for those who selected Internet sources. These included NASA, EPA, USDA, and NOAA/NWS in terms of government agencies. Other sources included 350.org and TED talks. A number of respondents also indicated they read scientific literature on the issue and some had even done their own research on the topic. Social media was not listed as one of the top sources for environmental information. However, the high number of respondents who indicated that they received some information from their friends and family means that these issues are being discussed by about one-third of the respondents.

Students were then asked if they thought that conservation was important. Nearly every student who answered this question responded that they believed that conservation was important. Some indicated that conservation should be economically viable and not hurt the people it’s trying to protect. It is true that this was a broad question, but the general consensus was that it is important, and the students seemed to realize that efforts must be undertaken in order to ensure that future generations are not harmed.

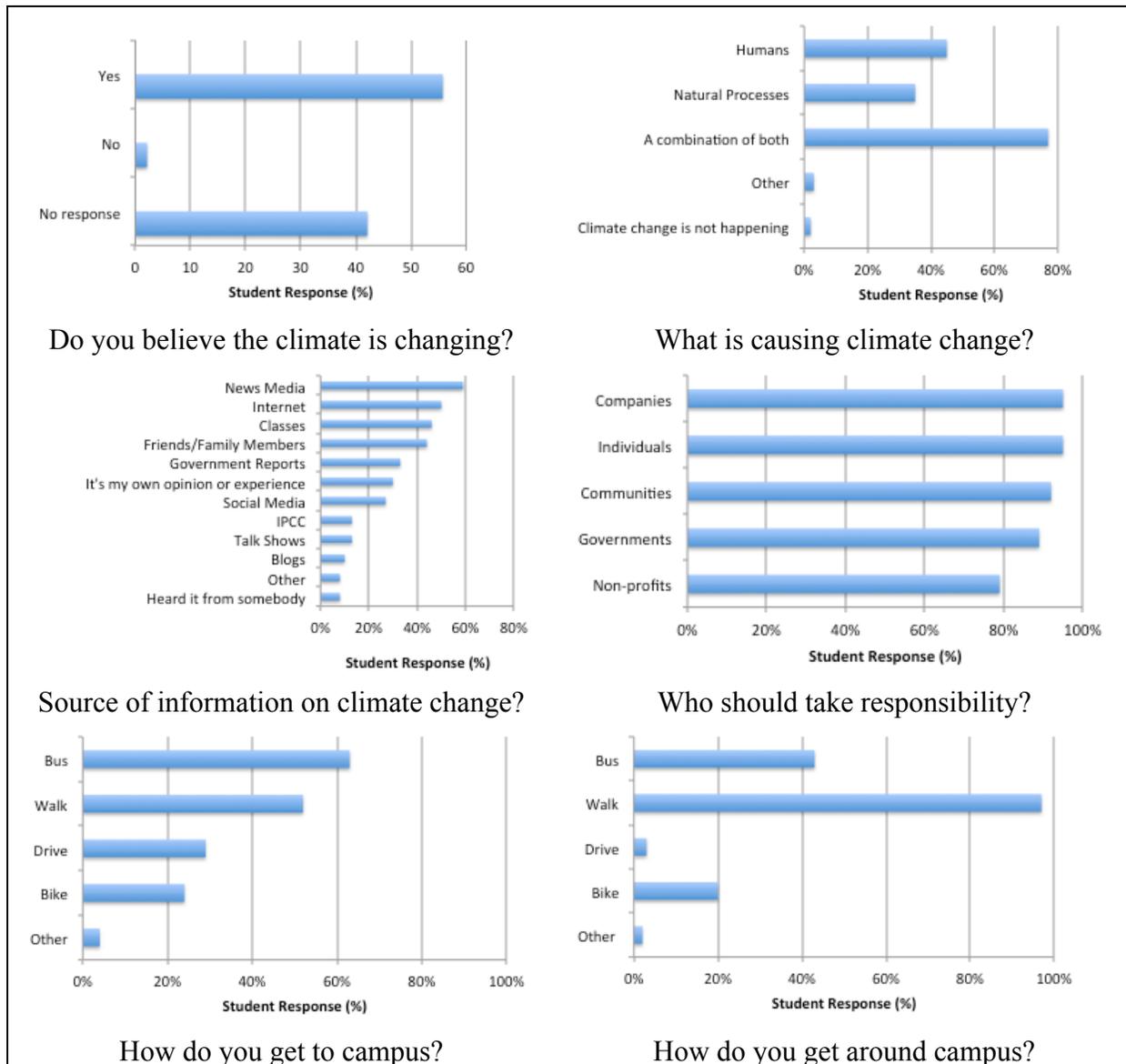


Figure 2. Overall student attitudes, perceptions, and habits.

We then asked a series of questions regarding responsibility and actions to improve the environment. When asked if they had a personal role in contributing to climate change, or if it was the university's role to adjust its actions, 461 respondents indicated that they believed it should be a combination between personal action and action taken by the university, 70 indicated that they believed only a personal role should be taken, and 47 indicated that they believed only the university should take action. Verbatim sample responses (including spelling errors) are provided in Table 1. Some respondents expressed concern that the university could do more to encourage sustainable practices, such as providing more recycling and composting opportunities, and that it has a responsibility to provide those services to the student body. Many responses suggested that the university's responsibility should be to provide services for students but it is the students' responsibility to use those services. Students indicated that they felt that the

university has the ability to take actions on a broader level, which will have an overarching effect on the university community as a whole. Individuals do not have that ability and therefore cannot effect as wide ranging of an impact on the university community. Still, many recognized that they have a responsibility to adjust their individual actions.

Table 1. Sample responses for personal role vs. university role.

<p>Both - I feel like students need to do all that they can to reduce their impact and the impact of the university - such as turning off lights in rooms when leaving, using the residence hall recycling system, and being smart about energy usage overall. However, there are many larger aspects to this on the Iowa State campus that students do not have control over that the university as a larger whole does. It's those types of things that should be the role of the university to change its actions.</p> <p>Both. The university may implement different environmentally friendly policies, but it is up to the students and faculty to really utilize them.</p> <p>Everyone plays a part in "contributing" to climate change but institutions should bear significant responsibility for helping create a path for change.</p> <p>I believe I have a personal role. Iowa State has offered resources to encourage conservation but it is my job to utilize them.</p> <p>I feel the university should head and facilitate an environment in which students feel compelled to and do play a role in conservation through recycling programs and other measures.</p> <p>It should be both the role of individual students as well as the University. The University is an entity as much as the people working in it, but it cannot change on its own. I feel the University should provide perhaps annual or semi-annual hearings on ideas to change policy on issues, including environmental policy. If such hearings exist, perhaps they should be made more visible to students.</p> <p>The university can't successfully implement changes if people won't go for it on a personal level, so you would need both groups to change in order to be successful.</p> <p>We should make it known to Iowa State that we want these changes to be made here.</p>
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More broadly, who should take responsibility for making changes to combat climate change? All respondents strongly felt that individuals, companies, and communities (>92%), but also governments (89%), and non-profit corporations (79%), bear this responsibility (Figure 2). The respondents clearly understood that the major contributors to climate change (companies and individuals), and governments and communities (who set and implement policies and regulations), all must work together.

In terms of what each individual can do to combat climate change, a wide variety of responses were given (Table 2 provides a sample of student responses). Out of 652 responses, several common themes arose organically. A number of respondents suggested voting for politicians who support for clean energy programs and "green" policy. Others suggested buying only products that are produced sustainably and from companies who are environmentally friendly. Many respondents said that each person should change their lifestyles and become more conscientious about how personal decisions affect the environment. Several suggested carpooling as a way to reduce one's carbon footprint, while many others suggested that individuals should drive less, take public transportation, or buy more fuel efficient cars. Several mentioned adjusting their diets as a way to be more sustainable, in addition to eating local foods, eating less meat, and eating less processed foods. Several responses mentioned the fact that it is the small, every-day decisions they make that have the largest impacts on the environment and are the easiest to change to reduce that impact. Several respondents listed making houses more

energy efficient and adjusting the thermostat to reduce energy consumption. Many respondents also mentioned using reusable bags for groceries instead of using plastic bags. The largest response, 223 out of the 652 respondents (34%), listed recycling as a way for individuals to impact the environment. As one respondent said, we need to stop the “buy and throw away culture.” Unfortunately, this is far easier said than done in our country.

Table 2. Sample responses for what individuals can do to combat climate change.

<p>Be cautious of how much energy you are using; this is not just the energy you used to drive your car around today. It's the much bigger picture. Every product you use, every meal you consume, takes a lot of energy to produce that comes from burning fossil fuels, or other sources of energy.</p> <p>Be conscious of how individual actions are affecting climate change and take small, manageable steps to minimize those effects.</p> <p>Care. We, as a people, need to understand what things don't need to be the way they've always been. Our culture needs to change. We don't need to drive everywhere we want to go, we don't need to live in three bedroom houses in the suburbs, and we don't need to rinse our Powerade bottles three times before we use them as water bottles. We don't even need individual Powerade bottles.</p> <p>Change daily behaviors, conserve energy, whether that's taking shorter showers, unplugging chargers, using energy efficient appliances, shutting off lights, making homes more energy efficient, driving less, driving more fuel-efficient cars, using solar and wind if possible. The list is long.</p> <p>First of all, be informed. You can never know where there's a need without a defined knowledge of the problem. Second, take initiative and DO SOMETHING (even if it's small) to work toward a goal. Join a club. Raise money. Recycle a milk carton.</p> <p>Individuals can make a lot of decisions that make a difference; choosing environmentally responsible products, reducing our consumption and therefore waste, becoming more efficient in our everyday lives, raising awareness about the issues at hand, educating yourself and many more. Individuals are the consumers of products and resources; if we demand more environmentally responsible products we will get them.</p> <p>Lifestyle choices and communication. Do what you can in your own life to reduce your energy consumption and make good choices as a consumer. Then, spread the word with your friends and family.</p> <p>Reduce, reuse, recycle. Being aware of what resources and how to dispose of products in an eco-friendly manner helps as well. Realize that we are contributing on some level and we should try to combat it. People state that they want a safer world for their children and grandchildren but fail to realize the effect that we have on the world in the present. If they want a world in the future for their kids, they can use or find renewable resources for energy. Individuals need to be open-minded and actually make an effort.</p> <p>Start with the easier things. Conserve energy in their living quarters, use reusable bags, recycle paper/plastics/glass/cardboard (whatever their community does), buy "green" products that are more efficient like toilets, dishwashers, washers, light bulbs, etc. If they have a bit more money than most, they should look into solar panels in their yard or roof, or perhaps a small turbine. It's the individual's job to steer the market towards a more renewable attitude. If we can affect the market, companies, industries, and governments will take notice.</p> <p>Stop the buy-and-throw-away culture. Reuse, recycle, donate items, buy used items.</p>
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When asked what companies can do to combat the effects of climate change, 628 students answered this question. Respondents strongly believed that companies have a responsibility to reduce their carbon footprint and overall environmental impact. As can be seen in some sample responses (Table 3), comments ranged from reducing water and energy use within facilities, to reducing the amount of packaging on products, and correctly labeling products as “green.” Many responses asserted that companies should focus on their environmental impact, and that more emphasis should be placed on long-term sustainability rather than on short-term profits.

Table 3. Sample responses for what companies can do to combat climate change.

<p>Adopt environmentally friendly practices as well as taking advantage of government programs that reward companies who are "green" companies. Educate employees and make a public stance in support of fighting man-made climate change effects.</p> <p>Be conscious of their actions and impacts they have - both on the environment, communities, individuals, etc. and make efforts to change practices that lead to negative impacts.</p> <p>Be more efficient about the energy they use, look for alternative fuel and energy sources, stop being so focused on money and short-term effects of the money and look at the long-term effects of their actions and what is better in the long run.</p> <p>Change manufacturing processes. Purchase raw ingredients that were produced from methods that had less greenhouse gas emissions.</p> <p>Companies can be held responsible for their own wastefulness and disasters. Companies should develop closed loop cycles for their products and tell the consumers who made this product what materials and energy went into it and how many greenhouse gases have been released by the time that you pick it up in the store has produced. Companies should look to the future of innovation of products that consume less resources and can be produced in factories run by solar, wind, renewable energy. The company should create easier ways to replace items instead of throwing a whole TV out when just one bulb on your screen is broken. Create technology that is interchangeable and promote ethical business practices. They should also be held responsible for spills and clean up of their own products. A company cannot own the patent on something but claim no responsibility when this product spilled and contaminating water for people down river.</p> <p>Companies can provide environmentally responsible products to the consumers, becoming more efficient in manufacturing of products, more efficient transportation of products and goods, making decisions based not only on profit alone and considering the weights of their actions.</p> <p>Make decisions not strictly based on profit but also on environmental impact. Use less materials, reusable materials, use solar and wind energy, provide carpools, discuss environmental issues with employees, partner with sustainable companies.</p> <p>Reduce disposable packaging, maximize shipping or production efficiency, employ local people and have offices near houses, use a carbon credit system, support local businesses when they make purchases, do more research before promoting something as a "green" item.</p> <p>So much more. They have the money to put policies in place and make a greater impact than an individual. They can be proactive in implementing energy and water saving policies, and not waiting until they government forces such changes.</p>
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When asked what governments can do to combat the effects of climate change, 617 students responded. Most of the responses to this question mentioned that governments should be taking actions both nationally and globally (Table 4). Nations have the broad reach that individuals and companies don't have, and can potentially make the most impactful decisions. Many of the suggestions given by respondents involved reducing use of fossil fuels and funding new energy sources, such as solar, wind, geothermal, and nuclear power, which could supply cleaner sources of electricity. Additionally, they also mentioned that governments should more strictly enforce environmental protection laws and impose stronger fines on companies who violate those laws. Another topic discussed several times was the creation of a carbon tax or cap-and-trade system, because the respondents thought that creating this system could help bring down overall emissions and increase revenue to the government to fund environmentally-focused projects.

When asked what non-profits and communities can do to combat the effects of climate change, 567 students responded. Many students focused on their personal and communal roles (Table 5). Comments included setting up recycling programs, encouraging the use of energy efficiency appliances, and pushing for the creation of public transportation systems (including bike lanes,

carpooling groups, and other forms of reducing individual car-based transportation). Implementing many small changes throughout many communities can have large overall impacts on the environment. By promoting environmentally sustainable lifestyles, communities and non-profits can contribute to revitalizing a cleaner environment due to their connection to large numbers of individuals and their ability to advocate for and implement change among many.

Table 4. Sample responses for what governments can do to combat climate change.

<p>By regulating car emissions. By giving power plants incentives to improve efficiency and update to newer technology (power plants are very stuck in their ways; if it ain't broke don't fix it. This is because it is often expensive to update the plants without long-term lifetime data of new technologies). Give incentives to manufacturers and companies to update facilities and build LEED certified buildings.</p> <p>Cap and trade, put money into research for biorenewables (energy, chemicals, etc.), put pressure on countries with bad practices (clear cutting forests, coal power plants) but also lead by example. Put money into conservation. Public transport.</p> <p>Create clean energy mandates for power companies, fuel efficiency standards for auto manufacturers. Tax carbon-polluting businesses - create incentives for renewable energy. Give tax breaks / credits to low carbon emitting businesses and individuals.</p> <p>Create more laws for citizens and companies to reduce pollution and waste, require recycling, create programs to encourage people to reduce their carbon footprint, charge more for imported foods and less for locally grown foods.</p> <p>Enact legislation that cleans up polluting industries, promote investment in clean energy sources, end our over-reliance on dirty transportation and promote cleaner transportation alternatives.</p> <p>Encourage the use of green technologies. Set environmental standards and force companies to meet them.</p> <p>Enforce greater climate change laws and work with other nations to collectively reduce our world environmental footprint. Collaboration, when effective and possible, is a great motivator of change.</p> <p>Fund renewable resources of energy specifically nuclear fusion, pass laws banning fossil fuel usage for energy (allowing for a progressive tapering off of use), give tax breaks to those who incorporate new efficient energy saving technology and renewable energy producers (solar panels, geothermal heat) into homes.</p> <p>Give monetary values to our natural resources based on ALL the services said resources provided so it will no longer be economically advantageous to operate at the cost of our natural resources.</p> <p>Have stricter rules for plastic, carbon tax, fix wealth inequality, regulations and subsidies, establish a government run recycling service i would pay taxes on that. Regulate chemicals and agriculture to promote sustainable practices.</p> <p>Incentive. Give individuals and companies a reason to care. Maybe the government should match investments. Hypothetical: BP increases its research funding to 13% which equates to x billion dollars, the government agrees to match 10% of that cost towards their research in order to reward that large increase in spending on research especially in the area of renewable energy.</p> <p>Promote sustainable activities through subsidies and extension programs. Quit subsidizing areas that do harm to the environment. Punish people, with jail time, who knowingly do damage to the environment.</p>

When asked what can be done on a global scale to alleviate the effects of climate change, 550 students responded. It appeared that most students realized that in order for emission reductions to be effective, they must be done on a worldwide scale (Table 6). Many discussed that implementing changes in individual countries can be a good start, but the most effective and realistic option for any real reduction in emissions of greenhouse gases is worldwide agreement. The students agreed that this is especially needed in countries like the United States, China, and India, who are the world's largest polluters, but have yet to take substantial steps to reduce their carbon dioxide emissions. Respondents also realized that there needs to be clear communication and collaboration between countries in order to facilitate these efforts. Furthermore, the students

understood that industrialized nations need to lead and set examples for the developing world by making substantive cuts to their own carbon dioxide emissions.

Table 5. Sample responses for what community and non-profit groups can do to combat climate change.

<p>Be green in their operations, much like the options I listed for people and companies. Start community programs educating people (especially the youth) about the effects of climate change and how they can help combat it. Encourage recycling programs.</p> <p>Come together to create a community that is close, caring, and committed to working for a healthier climate. Start car pooling groups, bike to work groups, composting/gardening clubs, freegan minded groups, etc.</p> <p>Communities can also theorize about new ways to organize which reduce waste and inefficiency, particularly in fossil fuel use. Using smaller scale projects they can test new solutions. There may be little that communities can do to combat climate change, although planting more vegetation might help to a small degree. Non-profits can help aid impoverished countries in building infrastructure to combat the effects of climate change.</p> <p>Increase awareness about the importance of the issue. Outline practical measures that can be adopted in households to combat this problem and encourage people to adopt these measures.</p> <p>Lobbying their legislators can be a powerful tool to effect change at a higher level. But if at all possible, communities and non profits can invest in small regional areas to change their energy use. Even a change in a neighborhood or town can be a big step.</p> <p>Many non profits and community based organizations can do a lot locally especially mitigating energy use. Much of the CO2 emissions that cause the effects of climate change are linked to domestic power plants, coal power plants. Forming community groups especially in poor neighborhoods to help them make their homes energy efficient can have a large impact. A group in Detroit reduced utility bills by as much as 50 percent in low income neighborhoods by providing free LED bulbs and basic energy efficiency evaluations. These were paid for by the utility company which in turn lowered their operating costs by having to generate less power.</p> <p>Non-profits and communities can help combat climate change by being the conduits between the science and the general public. We need to find non-threatening ways to communicate the science and show how climate change will impact people at an individual level. If they do not believe it will impact them negatively, there is little incentive to change. Communities can communicate climate change at that personal level.</p> <p>Stop focusing on climate scientists and the changing data. They should focus on promoting positive activities to reduce environmental impact without focusing on the science because the average Joe doesn't trust climate scientists because of the media. Promoting local gardens, recycling, conservation, carpooling, good stewardship, and energy efficiency will override any negative feelings about climate change. If non-profits and communities can show that these efforts will save individuals money and improve their life, they will be more likely to do it than if you shove data in their face and say change or we're all doomed.</p>

When asked what they thought about the role that science, technology, and engineering play in mitigating the impacts of climate change, 571 students responded. (Sample responses are provided in Table 7.) Overall, responses to this question reiterated the need to create new technologies and new sources of clean energy. Students seemed to understand that informed decisions can only be made if data has been collected and used to direct policies. In addition, they recognized that green technologies could play a role in reducing carbon emissions.

When asked if the humanities and arts play a role in mitigating the impacts of climate change, 559 students responded. Only 20 said “no”. Overall, respondents thought that the arts and humanities play a very important role, although it is different from that of science, technology, and engineering. (Sample responses provided in Table 8.) Students felt these disciplines fill a communication gap and should help effectively communicate the research from science and

Table 6. Sample responses for what can be done on a global scale to combat climate change.

<p>A coalition of countries and people, united in the common cause of planetary protection and sustainability. Better cooperation between nations, and nations actually signing agreements and sticking to them. Collaborate and communicate. Everyone should work together and pool resources and information instead of trying to be the first one to "invent the wheel". Communicate efforts to promote conservation between nations and provide their individual countries with information. Also set some goals for electricity usage and gas usage/fossil fuels. It would be nice to know how much of our resources are we using every day/month/year and be able to provide some goals for the country. Educate through national television services on how each country is doing with the amount of resources they are using. Then everyone knows where each country stands on the amount of resources used and then we can identify areas of improvement and then set goals that are achievable over time. Create awareness through the use of the United Nations. Generate regulations which help to put limitations on the amount of negative externalities a country can produce. Everyone needs to be more educated and find common ground to find a solution. Global collaboration to improve knowledge and understanding of the problem and then work to find multiple solutions that are applicable to each individual region. Because one solution will not work for the entire world. Have a diverse group of leaders without political affiliations or nationalities. Something like Marshal Plan where growing markets are supported by the richer countries, so that the growing nations need not resort to the environmental destruction that rich countries did. Make a plan that isn't too hard to follow and make people realize that something is happening. Don't come up with a plan that is to the extreme because that just makes people fight. Make recycling more accessible, recycle everything, invest in mass transportation (high-speed trains), tighter emission restrictions, invest in alternative energy sources. Partnerships between nations are essential if greenhouse gas emissions are going to be reduced. Especially, the EU, US, China, and India need to partner to reduce their emissions. The UN could play a role, but that is not so useful unless individual nations are willing to pay the price of changing power generation practices. UN recognizing that climate change is happening and having its members do anything they can to help combat it. World leaders come together to sign a pact to reduce harmful emissions, etc. in their countries. World powers need to take the lead. Instead of placing responsibility for climate change on those countries that are the poorest, industrialized nations need to be the ones to adopt change. We are the biggest extractors of the world's resources and we need to be the ones fixing this mess by spearheading the change.</p>

engineering to the common person. Further, students noted that the arts and humanities can show how normalized behavior contributes to the climate crisis, and could provide a shift in public thinking and perception of these issues. Music, art, television, and media function in a social and cultural realm, and so can reach people who may not otherwise understand or be willing to listen. And, students felt that these disciplines could allow more outreach to people within their homes and personal lives, and affect them in ways that scientific research doesn't. Through creating more personal connections to citizens, the arts and humanities can facilitate more affective interactions with environmental issues, leading people to feel an intimacy, an urgency, and a responsibility to adjust their actions.

Table 7. Sample responses for role of science, technology, and engineering fields.

<p>A lot of options for reducing energy or consumption of resources are too expensive to be practical. STEM fields need to work to improve these technologies so that they become more cost effective and more readily attainable. All three of these sectors have an important role to play. This role ranges from the discovery and understanding of the issues to explaining and disseminating the problem and solutions to lay people. Engineering and technology companies are also tasked now with solving the problem that we have created.</p> <p>Coming up with new green technologies.</p> <p>Creating processes that make carbon neutral living economically possible.</p> <p>Everything. Change certainly isn't coming from business folks. As scientists and engineers we need to find new technologies which alleviate the environmental impact we are creating. This may include "geo-engineering" technologies but also "green" technologies.</p> <p>Help identify extent of changes and predict potential impacts (flooding, reduction in food production, sea level changes, extreme weather). Create technology that reduces emissions and carbon footprint (hydrogen fuel cells, electric cars, more efficient solar panels, etc.).</p> <p>HUGE role. It's up to technology and science to help find more efficient and sustainable forms of energy. People won't do what they need to stop global warming if it's uncomfortable/ inconvenient for them, so we're probably going to need better technology so they can reduce their emissions without noticing that they're doing so.</p> <p>Provide pragmatic solutions, keeping in mind the politics of the situation and what the arguments against sustainability are (cost effectiveness, reliability, etc.).</p> <p>Science is meant to provide evidence so that countries, governments, communities, and individuals can make educated and evidence-based decisions. Technology and engineering drive innovated solutions to the issues that science brings to light. All of these are tools that individuals, communities, and governments need to make use of to reduce climate impact.</p> <p>The more we learn about the environment and our impact on it, the more we are able to formulate a response. The STEM fields can help improve overall efficiency, develop new emissions-cutting technologies, issue recommendations, and provide high-quality, reliable data for decision makers and the public.</p> <p>They can help solve the problems, and create new ways to combat the issues.</p> <p>This role is enormous: we must establish new ways of doing everything, as most 'old habits' from circa 1950 and earlier are wasteful and uninformed. Transportation needs to be reinvented, construction needs to be sustainability leading to sustainability, and new or improved energy sources are a must.</p>

When asked what might encourage them to be personally accountable for their own actions, 556 students responded. (Some of the responses to this question are provided in Table 9.) Ironically, several respondents stated that technology that would remind them of, or show them, their daily impact might encourage them to be more accountable for their actions. For example, an app that indicated how much carbon they emitted each day based on their activities, and which offered a perceived or virtual reward when they reached a specified goal for recycling or walking instead of driving, could potentially help them make more sustainable choices. Respondents were somewhat split between wanting to be rewarded for their actions, and simply being aware of what consequences their actions had and then acting accordingly to reduce that impact. It should be noted that education and awareness about actions and impacts aren't always effective as motivations in themselves, which can be true even if people see a direct personal benefit. Personal accountability is further explored in Burke and Rosentrater (2017).

Table 8. Sample responses for role of non-science fields.

<p>Absolutely. Business people, architects, and designers can work together with scientists to help create buildings that are eco-friendly. Educators can work to create meaningful curriculums out of the data that scientists provide us to make learning about the environment easier.</p> <p>Advertising, Communications, Marketing, The Arts- Can all send messages to the public. If they are surrounded by positive comments on good techniques for our environment, they will want to join in.</p> <p>All of the non-science fields should be involved in the transdisciplinary process. Not everyone responds to hard science facts. The challenge is to translate the science to being able to communicate effectively in other mediums, without losing the science.</p> <p>Definitely! I would argue that they do more so than the scientists. We scientists, of course, have contributed by advancing technology and knowledge. We need that. However, if science, as it is today, is to be communicated to the general public in a meaningful way, art is the way to do it, I think. What is more inspiring than a beautiful piece of music? Or a novel? My favorite is photography and I know many photographers have taken on the project of combining their passion of creative expression with a message of 'climate change' awareness.</p> <p>Environmental Justice Movement is something historians have brought to light. Movies, plays, books about climate change could wake people up. Think about the profound impact Jaws had on a generation. What if somebody wrote an amazing science fiction film about climate disaster? Maybe this could spur people on to fix the problem.</p> <p>I think they play a role by conveying social norms. If people see sustainability in all aspects of life, they're more likely to partake in those behaviors themselves</p> <p>Non-science fields can help educate the populace on the effects of climate change and can argue for various things such as the morality of saving the planet or the natural beauty that could be lost to future generations.</p> <p>Something as simple as a book can change the way we think about a topic. Silent Spring, for example, drastically altered our thinking about radiation and the like. So, yes, the humanities can play a part if they choose to.</p> <p>Yes I believe they do. Climate change will have serious human impacts. The humanities allow people to understand how people generally interact with each other, why and how choices are made. Better understanding the human condition will allow us to better predict the reactions the world may have to the unintended consequences of our carbon emissions.</p> <p>Yes. People are emotional creatures and art and music appeal to us in a way research won't.</p>

In terms of getting to campus each day (Figure 2; 763 respondents), 24% arrived by biking, 52% by walking, 29% by driving, 63% by bus, and 4% other. Since the majority of students either live on or near campus, walking, biking, and riding the citywide bus system were the most convenient forms of transport. Even though there is limited parking available to students on campus, almost 1/3 of students drove to campus. Why did respondents (705) choose the option they did? Primarily cost and convenience were the overriding factors, not environmental choice or a desire to be more environmentally conscious, and these findings apply to how students get around on campus as well.

When asked how they navigate campus (762 respondents), almost all do so by walking (739; Figure 2), while slightly less than half (330) use the university bus system. Almost 20% (151) used a bicycle for transport on campus. Once again, the overarching factor when deciding how to get around campus was convenience. Most students walk because it is the easiest option available to them, not because it is a healthier choice or a more environmentally friendly choice.

Table 9. Sample responses for what might encourage people to be personally accountable.

<p>A sense of duty, community. A belief that my actions have purpose and make a difference. Noticeable positive impact on my life and/or the lives of those I care about.</p> <p>A tracker on my phone that would tell me how much greenhouse gases I omitted through my travels, etc. There could be goals to reach - and if you recycle, then you could get "rewards". I could see it being like a health app.</p> <p>An easy way to track my carbon impact, apps, etc.</p> <p>Becoming more educated about how the choices I make can impact the climate. I think that the general public understanding the problem is the first step to alleviating climate change concerns.</p> <p>Convenience and affordability of 'greener' options would help motivate me. In my opinion, incentives are better than punishments.</p> <p>Easy access to sustainable options: food, recycling.</p> <p>Education as to how I personally impact climate change.</p> <p>For individual's personal encouragement, we can raise awareness on campuses and even within classrooms, as well as including more days devoted to energy conservation, like days where we leave the lights off in the classroom, or weeks where we all try to bike to campus, and maybe even days where we refrain from using electricity (except, maybe, for heating) after sunset.</p> <p>Having a better understanding of the issues at hand.</p> <p>Humans are lazy. The easier it is made to recycle, be efficient with natural resources, eliminate waste products etc. the more likely that people will do their part. The harder or more effort people have to do the less likely they will be to do it.</p> <p>I am already accountable for my actions.</p> <p>I don't know.</p> <p>I think most people are influenced most by their peers and by the role models they look up to. Unfortunately, most people's role models are celebrities who do not live such clean lifestyles, but if protecting the environment becomes a trend and stays a trend, I think most people will start to listen to those who say what and how we do things is affecting the earth in a drastic way.</p> <p>Knowledge of my impact.</p> <p>Money or other reward for doing the right thing.</p> <p>Reminders.</p> <p>Show personal energy consumption statistics, usage reports of food, energy, paper, gas, and other raw materials and how that would impact the environment.</p> <p>Tax incentives.</p>

Conclusions

From our survey of students, all indications are that ISU students have a fairly high comprehension of major issues related to human impacts on the environment and to climate change. They do not, however, fully embrace personal actions to lower their impact on the environment. Some of this may be related to their acceptance of personal responsibility; some may also be due to their perception that the university could do more to facilitate these actions.

One of the key messages from the survey was that the student respondents were very interested in having ISU obtain more of the campus' energy supply from renewable sources. For example, students were quite interested in wind and solar as potential energy sources for the university. Not only could these alternative energy sources reduce the campus carbon footprint, but they could also offer new opportunities for teaching and public outreach.

Furthermore, students were very interested in increasing campus-wide recycling efforts, adding composting capabilities, and expanding public transportation. Specifically, they felt that the

availability of recycling containers and encouragement to recycle could be increased throughout the university, and by “recycling” they meant the recycling of trash as well as composting of food and other organic wastes. Ironically, many students were actually aware of the quantity of waste that they were producing, and they did want options for lowering their environmental footprint (other than reducing their own consumption, that is).

It appears that students have a strong desire for ISU to play a bigger role in not only improving campus environmental performance, but also to increasing educational efforts related to sustainability. Students want to learn more about what they can do on a personal level to care for the environment and promote good stewardship. As with society at large, however, they don’t necessarily want to pay more money to successfully achieve these efforts. By and large, Iowa State University students are aware of sustainability issues, but more efforts are needed, both on a personal as well as a campus level.

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Appendix – Survey Instrument Distributed to ISU Students

Part 1. Demographics

1. What college is your primary major in?
 - Agriculture and Life Sciences
 - Business
 - Design
 - Engineering
 - Graduate
 - Human Sciences
 - Liberal Arts and Sciences
 - Veterinary Medicine
2. What is your major?
3. What is your minor? (If applicable)
4. What gender are you?
 - Male
 - Female
 - Other
5. Are you a graduate or undergraduate student?
6. Where do you live?
 - Residence hall
 - Apartment
 - Non-apartment off campus
7. Where are you originally from?
 - Iowa
 - Outside of Iowa but within the United States
 - International
8. What political affiliation do you identify most closely with?
 - Conservative
 - Independent
 - Liberal
 - Libertarian
 - Other
 - None

Part 2. Attitudes, Perceptions, and Habits

9. Do you believe climate scientists who say that the climate is changing?
10. What is causing the climate to change? (select all that apply)
 - Humans
 - Natural Processes
 - A combination of both
 - Climate change is not happening
 - Other (please specify)
11. Where did you get your information on climate change issues? (select all that apply)
 - News media
 - List sources
 - Social media
 - List sources
 - Internet
 - List sources
 - Classes
 - List specific classes
 - Friends/Family members
 - Talk shows
 - Blogs

Heard it from somebody but you haven't checked it for yourself
It's my own opinion or experience
Government reports
IPCC
Other (please specify)

12. Do you think conservation is important?
13. Here at Iowa State, do you feel you have a personal role in contributing to climate change or is it the university's job to adjust its actions?
14. Who should take responsibility for making changes to combat climate change? (select all that apply)
 - Individuals
 - Companies
 - Governments
 - Non-profits
 - Communities
15. What can individuals do to combat the effects of climate change?
16. What can companies do to combat the effects of climate change?
17. What can governments do to combat the effects of climate change?
18. What can non-profits and communities do to combat the effects of climate change?
19. What can be done on a global scale to alleviate the effects of climate change?
20. What role do science, technology, and engineering play in mitigating the impacts of climate change?
21. Do the non-science fields (e.g., the humanities, the arts) play a role in mitigating the impacts of climate change? If so, what role do they play?
22. What would encourage you to be personally accountable for your own actions and how they may impact climate change?
23. How do you get to campus on a daily basis? (select all that apply)
 - Bike
 - Walk
 - Drive
 - CyRide (bus)
 - Other
24. Why do you choose that option?
25. If you drive to campus, do you park on campus or in the commuter lot? (select one)
 - Park on campus
 - Park in commuter lot
26. Why do you choose that option?
27. How do you get around campus? (select all that apply)
 - Walking
 - Biking
 - Taking CyRide (bus)
 - Driving
 - Other
28. Why do you choose that option (open response)

Part 3. What do you know about environmental issues?

29. Rank these issues from least to most important issues that should be dealt with first with 6 being the least important to 1 being the most important.
 - Global warming
 - Ocean acidification
 - Long-term drought
 - Sea level rise
 - Ice cap melting
 - Burning of fossil fuels
30. Rate how much you think the above issues affect you on a daily basis. 5 being having no effect on you to 1 being having a large effect on you
0 1 2 3 4 5

31. Rate how much you think the above issues will affect you in the next 10 years. 5 being having no effect on you to 1 being having a large effect on you
0 1 2 3 4 5
32. Rate how much you think the above issues will affect you in the next 50 years. 5 being having no effect on you to 1 being having a large effect on you
0 1 2 3 4 5
33. Do you support replacing fossil fuels with renewable energy such as wind and solar on a national scale?
Yes or No
34. Why did you choose that option?
35. How much extra would you be willing to pay for renewable energy on a nationwide scale?
10% more
25% more
50% more
Other (please specify)
36. Do you support the city of Ames in burning its trash for electricity?
Yes or No
37. What benefits do we receive from burning trash?
38. What are the environmental implications and other concerns of burning trash for electricity?
39. How often do you recycle?
Never
Once a month
Once a week
Every day
40. What do you recycle?
Glass
Plastic
Papers
Electronics
Cardboard
Other
41. Where do you recycle?
Residence halls
Garbage hauler picks it up
Drop it off at the recycling center
Other
42. If you recycle, do your parents or other people close to you influence your decision whether or not to recycle?
Yes or No
43. Are you familiar with ISU's Live Green initiative?
Yes or No
44. In a few sentences describe the goals of the Live Green Initiative.
45. How can ISU get you more information about their Live Green Initiative?
46. Do you know what LEED Certification is?
Yes or No
47. How many buildings on campus are LEED Certified?
48. Do you turn off the water when brushing your teeth?
Never, Rarely, Sometimes, Often, All of the time
49. Do you use a reusable water bottle?
Never, Rarely, Sometimes, Often, All of the time
50. Do you turn the lights off when you leave a room?
Never, Rarely, Sometimes, Often, All of the time
51. Do you wash clothes in cold water? (select one)
Never, Rarely, Sometimes, Often, All of the time
52. Do you power down your laptop, gaming system, TV, etc. when not in use? (select one)
Never, Rarely, Sometimes, Often, All of the time

Part 4. What can ISU do to help you improve your environmental footprint?

53. Do you think the university could do more to have more of its energy come from renewable sources?
Yes or No
54. Please describe how.
55. How much more tuition are you willing to pay to have more energy come from renewable sources?
10%
25%
50%
Other
56. Would you be in favor of Cy-Ride using more fuel-efficient buses, even if it meant there were fewer buses available?
Yes or No
57. Why do you think that?
58. Would you support a university-wide bike share system that would allow you to check out bikes to ride around campus?
Yes or No
59. Why do you think that?
60. Would you like to see more access to recycling for students on campus?
Yes or No
61. Why do you think that?
62. How much more access would you like to see for recycling?
63. Would you pay extra for post-consumer recycled products such as paper or plastics in the cafes and dining centers? (e.g., buying coffee)
Yes or No
64. How much extra would you pay?
.05-.10 cents extra per cup?
\$1 extra per cup?
Other
65. Should there be a tax or surcharge on paper cups to encourage the use of travel mugs?
Yes or No
66. How much of a tax should be imposed?
67. Should the university ban the use of one-time-use plastic water bottles?
Yes or No
68. Why do you think this?
69. Should the university ban the use of plastic bags?
Yes or No
70. Why do you think this?
71. Would you support paying an extra fee with tuition costs to support services such as recycling, composting, and other green initiatives as determined by an advisory committee?
72. Why do you think this?
73. Would you compost if the University provided a way to compost food waste?
Yes or No
74. Why would you do this?
75. How much more would you be willing to pay per meal to compost food?
10% more
25% more
50% more
Other
76. Would you pay more for food if it supported local farmers?
Yes or No
77. Why would you do this?
78. How much more would you be willing to pay per meal?
10% more
25% more
50% more
Other



Kurt A. Rosentrater



Brianna R. Burke

