How Northfield Engages with Climate Change: A Project Completed for the Greater Northfield Sustainability Collaborative.

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Twenty-nine people from within a 15-mile radius of the city of Northfield were interviewed between May and September in 2017 in order to understand what their knowledge about climate change is, from where they get their knowledge about climate change, what actions they are taking, and what their suggested solutions to climate change are. This project was completed to enhance the future climate change community engagement activities of the Greater Northfield Sustainability Collaborative (GNSC). Given the City of Northfield's recently approved strategic goal to plan for climate change, the results from this project can help in developing a climate change communication and outreach program, a climate change community survey, and provide content for town hall forums.

The group of 29 interviewees, hereafter referred to as "the group," provided an excellent range of perspectives. What follows in this section is first an overview and aggregation of the group characteristics: what they know about and if they act on climate change; why they have difficulty acquiring knowledge and taking action; and what their suggested mitigation and adaptation solutions are for the City of Northfield and broader—state and federal—leaders. The remainder of this section then introduces variation among individual interviewees. While the group perspectives give a cumulative picture of the group's engagement with climate change, the analysis of each individual interviewee revealed that the group is not homogenous. Measuring the amount of knowledge, action, and social participation of each individual shows the degree to which each individual is engaged with climate change. Individual engagement with climate change ranged from minimally to moderately and finally to the most engaged.

Group Knowledge and Action

Overall, the group is knowledgeable about climate change and is taking some action:

- 90% of the group can provide a basic definition of climate change as a weather-related event.
- 100% of the group has observed at least one from of climate change: increased temperature or precipitation or less severe winters.
- 100% of the group gave at least a few examples of the ecological, economic, or social consequences of their observed climate changes. Complete summaries of the observations and consequences are in Appendix 1.
- 93% of the group are taking at least one basic individual action, such as energy conservation or recycling, to lessen the impacts of climate change.

Group Barriers to Knowledge and Action

From the interviews, barriers to knowledge about climate change that the group identified included lack of time, interest, and skill; lifestyle choice; and lack of access to simple and accurate information. Misinformation, no information, too much information, or complicated information were the most frequently mentioned barriers to knowledge. Barriers to action were personal preferences, political inertia, and economic livelihoods. Personal preference was the most frequently mentioned barrier to action and included lack of time, energy, and money, and wanting to maintain one's current lifestyle as well as participation in certain groups that do not promote

action. Complete summaries of the barriers to knowledge and action compiled from the interviews are in Appendices 2 and 3.

Three unexpected and recurring barriers emerged from the group interviews. The first was lack of concern which can be attributed to the perceived positive effects of climate change such as Minnesota's shorter and milder winters that allow for extended growing and construction seasons, or the feeling that may contribute to the lack of concern as one interviewee mentioned, "I mean, we're in Minnesota, so frankly, time and change based on the models is not going to damage us as much as others." The second was uncertainty with regards to what constitutes climate change as one interviewee relates: "Is that part of climate change? I don't know." The third was frustration due to the lack of control over the action of others. 26 out of 29 interviewees mentioned the damaging effects of agricultural practices such as tiling, tilling, buffer zones, and chemical use and how these contribute to greenhouse gases, flooding, and other environmental problems.

Group-suggested Solutions for Broader Leadership

The group suggested that our leaders should:

- Stop the debate about climate change
- Educate the public to promote collective responsibility.
- Invest widely in climate-friendly sustainable practices
- Provide incentives and programs for individuals and businesses to be able to participate in sustainable practices
- Change and enforce legislation to mitigate and adapt to climate change
- Accelerate renewable energy technology
- Carefully transition to other energy sources
- Create a comprehensive transportation system
- Insist on the best agricultural practices

A summary of the suggested broader leader solutions can be found in Appendix 4.

Additionally, the group also had specific suggestions to help the city of Northfield mitigate and adapt to climate change. The group suggested that the city provide more climate change/sustainable education in the schools and within the community. Furthermore, the group suggested the city support its citizens by initiating, updating, and enforcing policies, codes, and incentives that will ensure green or smart building practices, make renewable energy options available, require better land use practices, and provide additional public transportation options.

Appendix 5 contains the complete list of solutions for the city.

Individual Variation

A more in-depth look at the group data revealed there was considerable individual variation within the group. Some of the participants had more knowledge about climate change than others and made more individual contributions to lessen the impacts of climate change, while others had less knowledge and/or acted less robustly to lessen the impacts of climate change. Social participation, where one seeks, hears, and exchanges information about climate change, seems to

contribute to the degree in which individuals acquire useful knowledge and take action, or, in other words, determines the level at which one engages with climate change.
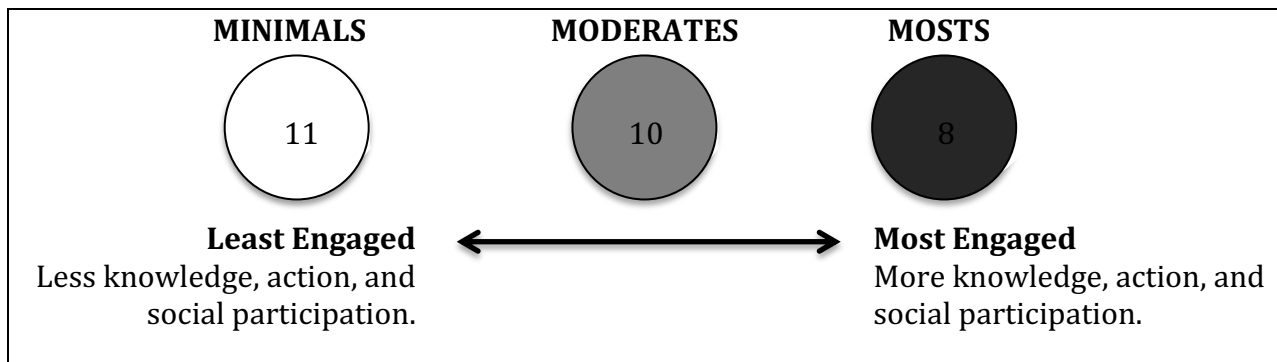
Figure 1. Three sub-groups

Figure 1 shows three distinct sub-groups that engage in varying degrees with climate change: minimally, moderately, and most strongly. Amount of knowledge, degree of action, social participation, and suggested solutions have been used to determine the level of individual engagement within each of the three sub-groups. These three sub-groups are hereafter referred to as the 'Minimals', 'Moderates', and 'Mosts' and are discussed further in the Findings section.

METHODS

Participant Selection
Participants were selected based on age and occupation. 67 individuals 30 years of age or older were recruited face-to-face, via email, postal mail, and by telephone. 37 individuals initially said agreed to participate. 30 individuals completed the interviews. One interview was omitted as it was missing too much data. The age group aged 30-49 was the most difficult to recruit. 18 of the 22 possible standard occupational classification system categories were represented. The United States government uses the Standard Occupational Classification System to collect occupational data.

Data Collection
A semi-structured interview guide was constructed to ask the participants similar questions about climate change. The interview questions generated data about each participant's personal experience with climate change. All interviews were audio recorded and transcribed.

Data Analysis
A codebook was constructed to help categorize the participants' responses to the interview questions. This helped the researcher sort the transcribed interview into similar categories. Three different analysis strategies were used: deductive, inductive, and recursive. A deductive approach assigns or tags participant responses to predetermined categories. For example, the categories for observing climate change were winter, temperature, and precipitation. When an interviewee spoke about a change in winter, that portion of the text was tagged and inserted into the winter category. The inductive approach allowed for categories to emerge as the researcher became successively more familiar with the data. For example, the barriers to action categories -- personal

preferences, political inertia, and economic livelihoods -- only became apparent after the transcripts were read and re-read to obtain the overall voice of the group. The recursive approach involves revisiting the data and adjusting the codebook rules as new insights appear. For example, measuring the degree of individual engagement (an insight that emerged later in data analysis) required using a ranking (value) system versus categorical (tagging) system.

To measure the degree of individual variation in the data, a ranking system using 11 of the codebook measures to place individuals into one of three sub-groups (Minimals, Moderates, or Mosts) -- depending on their engagement level with climate change – was used. The more knowledgeable or action-oriented a participant was when answering specific questions, the higher the ranking he or she received. For example, one of the 11 measures asked, "What are you doing to lessen or adapt to climate change?" The participant's answers would be placed into one of five categories: energy, transportation, consumption and waste, land, or advocacy/education. The participant was then ranked for that measure per number of total categories to lessen or adapt to climate change that he or she was participating in. All 11 measures in the areas of knowledge, action, social participation, and solutions were ranked in this fashion. The 11 ranked measures were tallied to determine the level of total engagement of everyone. Group inclusion scores were determined for the Minimals, Moderates, and Mosts. The individual was placed in the group with the corresponding score.

See Appendix 6 for further explanation of the 11 measures.

DEMOGRAPHICS

Table 1 Gender and Age.

	GROUP n=29	MINIMALS n=11	MODERATES n=10	MOSTS n=8	
GENDER					The Mosts were more evenly distributed on gender and age than the Moderates or Minimals.
Male	66%	72%	70%	50%	
Female	34%	28%	30%	50%	
AGE					
30-49	21%	18%	20%	25%	
50-69	62%	64%	70%	50%	
65+	17%	18%	10%	25%	
AVERAGE AGE					
	58	59	57	59	

Table 2 Locations.

	GROUP n=29	MINIMALS n=11	MODERATES n=10	MOSTS n=8	
PERCENTAGE OF EACH GROUP THAT IS A					The Moderates and Mosts have fewer MN natives. The Mosts have lived the longest in Northfield, an average of 33 yrs.
MN Native	72%	73%	60%	63%	
Midwesterner	20%	27%	30%	25%	
Other	8%	0%	10%	12%	
AVERAGE YRS IN NORTHFIELD					
	26	23	21	33	

Table 3 Percentage of Social Participation.

PERCENTAGE OF PARTICIPATION					Of the five main social participation categories, the Moderates and Mosts participate more broadly than the Minimal group.
Number of Groups*	GROUP n=29	MINIMAL n=11	MODERATE n=10	MOST n=8	
1	3%	18%	0%	0%	
2	20%	27%	20%	25%	
3	52%	46%	40%	38%	
4	21%	9%	40%	25%	
5	4%	0%	0%	12%	
*Participation categories are Outdoor Activity, Church, Business, Social Causes, and Civic.					

The above group demographics provide an opening glimpse as to why engagement levels in climate change are higher for the Moderates and Mosts. The Moderates and Mosts are somewhat more diverse in terms of how they participate in life, and they are not as singularly MN natives. Perhaps because of their life experiences, they are hearing about and seeing the wider effects of climate change.

FINDINGS

Knowledge and action are the first way to explain the differences between the three sub-groups. The Minimals show both less knowledge and action, the Moderates show more knowledge but less action, and the Mosts show the most knowledge and action. Social participation, wherein one seeks, hears, and exchanges climate change information, may be seen as the mediator of knowledge and action.

Knowledge

What the three sub-groups know about climate change was measured by how they defined climate change, how many observations about climate change they made, and how many climate change consequences they named. In Figure 2, each column represents the degree of knowledge within a specific knowledge area each group possesses. For example, the Minimals accumulated only 40% of the total number of points toward robustly defining climate change.
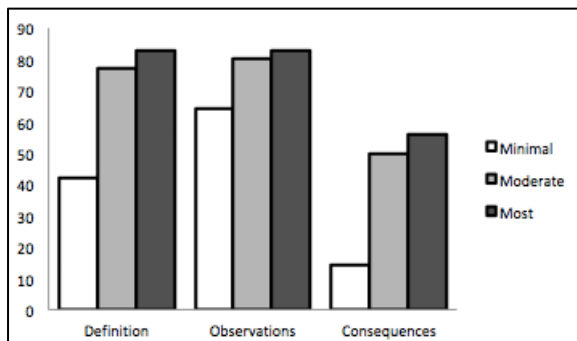

Figure 2. Percentage of total knowledge

From Figure 2 one can also see that the Minimals fall shorter on all measures of knowledge while the Moderates and Mosts are more similar in their knowledge.
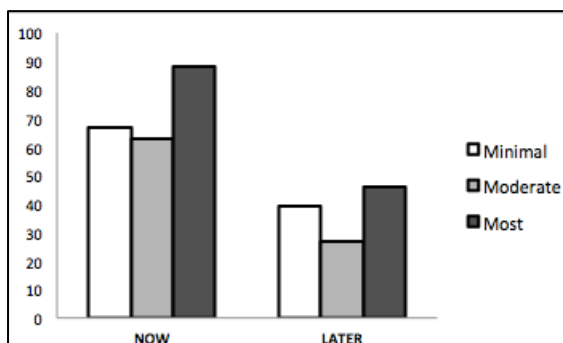
Action

Figure 3. Percentage of total action

Figure 3 indicates how the three sub-groups are taking action both now and later. Taking action is defined as making a contribution toward reducing and mitigating climate change in the following areas: energy, transportation, consumption and waste, land use, and or helping to advance advocacy/education. Figure 3 indicates that the Mosts are participating at close to 100% in all the action now categories while the Minimals and Moderates lag. Energy and waste are the most talked about actions while consumption is rarely mentioned as a self-action.

The taking action later percentages are low in all sub-groups. This may indicate that all groups think they have run out of options, do not know what other options there are, or cannot participate for economic or other reasons.

Social Participation
How and where these three sub-groups acquire knowledge uniquely suggests why levels of engagement with climate change are encouraged or limited. Social participation is measured in the following four ways: trusted source of climate change information, hearing others talk about climate change, type of activity, and knowing what actions the city is taking.

Trusted Source
Participants were asked, "What source would you trust if you wanted to learn more about climate change?" Figure 4 shows the most trusted source -- mainstream media or a scientific source. Media is defined as mainstream print news, TV, and online sites. Most participants in all sub-groups trusted the media but the Minimals stood out as identifying media sources as the most trusted. Participants in all sub-groups mentioned repeatedly how difficult it is to recognize accurate information.
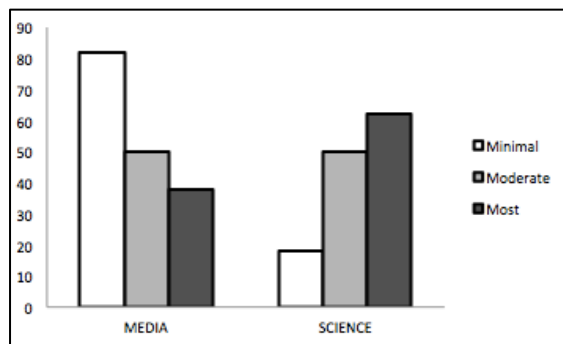
Figure 4. Trusted Source

Others Talk
Participants were asked, "When you are out and about running errands, eating dinner or at social events, do you hear others talking about climate change?" The Minimals and Moderates answered "No, not much" most often. This may be attributed to social setting and interactions. Certain activities and interactions contribute to more or less discussions about climate change.
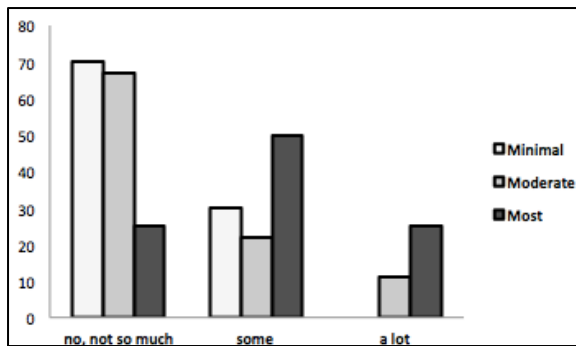
Figure 5. Hear Others Talk

Type of Activity

Social participation may also explain the sub-group differences with regards to knowledge and taking action. Figure 6 shows that Moderates and Mosts participated in more social cause and civic activities than the Minimals, and although the Moderates and Mosts appeared more similar in which activities they participated in, the Moderates and Mosts differed in the amount of participation they had in business groups.
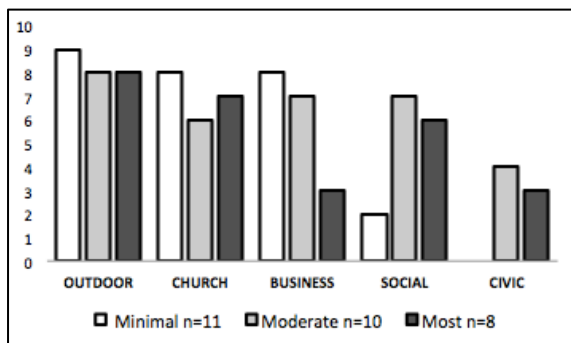
Figure 6. Type of Activity

Awareness of City Actions

How is the city taking action? This question is relevant in the social participation section because knowing what the city is doing requires some amount of social cause, civic involvement or participating in a particular type of activity. It is important to note that 14 out of 29 participants said they didn't know what the city was doing or had delayed responses in answering the question. The Minimals knew the least.

Figure 7. Percentage answering, "How is the city taking action?"

CONCLUSION AND RECOMMENDATIONS

It is fair to say the entire group has experienced climate change. This group possesses shared local knowledge that provides evidence that temperatures are warming, winter is changing, and precipitation is increasing. Appendix 1 contains the group's climate change observations and the consequences of those climate changes. All members 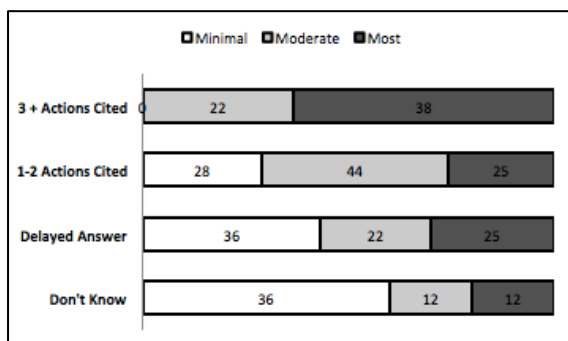of the group are taking action or participating in the options available to them to mitigate and adapt to climate change. Robust action, however, is not the norm. More coordinated efforts are needed to inform the public about the importance of their role and provide them with easy tools to participate. The group members have also contributed a great number of suggested solutions for the City of Northfield leaders and the broader leadership. They understand that local effort is very important, but effective local effort requires broad collaboration with state, regional and national systems working together. See Appendices 4 and 5 for these suggested solutions for our leaders.

This group also recognizes that there are barriers to knowledge and action. See Appendices 2 and 3. The mentioned barriers to knowledge included lack of accurate information, time, skill, and interest such as wanting to maintain a particular lifestyle. The mentioned barriers to action included a lack of easy access to mitigation and adaptation options due to political, regulatory, or economic reasons. Additional barriers included a lack of a sense of urgency and uncertainty -- all of which call for better communication and educational approaches.

Beyond these aggregated group characteristics, individual engagement with climate change varies greatly. How and where people get their knowledge seems to be a key link for more or less individual engagement with climate change. These interviews revealed that those individuals deemed most engaged with climate change are more involved in more diverse social activities. Social participation, where and with whom people spend their time, can be a barrier to knowledge and action. Therefore, introducing more broad and effective communication and engagement activities into the community is necessary to boost the current local knowledge and action on climate change.

Appendix 1a: Precipitation – Group Observations and Consequences

MORE PRECIPITATION "...get less value out of the rain."			
Group Observation	Consequences of More Precipitation		
	Ecological	Economic	Social
Longer, heavier more intense rains.	More rain is good for plants	More mowing jobs	Plants are lush
	Erodes soil, loss of nutrients	Cost to farmers Difficult to build in wet soil	
	Causes run off from roads and fields polluting the water and harming aquatic life	Cost to cities and state (one city's run off is another city's problem) Cost to or loss of business (tourism)	Lakes and streams unsuitable for recreation – swimming and fishing.
	Contributes to algae growth (connected to over fertilization)		Algae unsightly - aesthetic Algae a health issue to humans and animals
	Hurts the watershed because it does not soak in. Just goes into the rivers.		
	Pooled water stays in low lying areas	Damage to crops	Insect breeding – health issue
	Flooding	Health and insurance costs	Mold in homes "I think that's (drainage tiles) the biggest cause of our flooding here."
		Infrastructure not designed to withstand increased precipitation (river towns, transportation systems, bridges, treatment plants, septic systems)	Service disruption
		Damage or loss of property, home, and business (condemnation due to contamination). Loss of work, productivity and revenue Cost for debris clean up and renovation	Human displacement
		Health care costs	Human injury

Appendix 1b: Winter – Group Observations and Consequences

WINTER Both good and bad impacts to less winter.			
Group Observations	**Consequences of Less Winter**		
	Ecological	**Economic**	**Social**
Less Snow	Less insulation for ground	Infrastructure damage Plants may not be able to over-winter.	
	Less spring moisture		
		Innovation to manufacture snow Winter businesses, less tourism and lost revenue Winter event cancellation and loss of revenue	Limits Outdoor Activities: Cross country skiing, downhill skiing, snowmobiling, snow sculptures, dog sled races, and ice fishing contests.
			Loss of cultural heritage - white Christmas
		Less snow removal costs Loss of snow plowing jobs	Less snow on roadways
			Fewer heart attacks from shoveling
		Less reflected, passive sunlight available from snow (energy)	
More snow/precipitation State data = initially more heavy, later less actual snow.		More snow removal costs	More snow on roadways
Warmer winter temperatures	Winter season starts later and ends earlier	Longer growing season	Longer outdoor activity
	Snow melts earlier	Loss of business and tourism income	Outdoor winter activities are limited
	Thaw and refreeze	Expense to maintain roads and infrastructure	
	More ice storms may require more salt on roadways. Salt gets into lakes, rivers and groundwater.	Expense to maintain roads and clean water systems. Medical expense Loss of work	Dangerous travel, commuting Personal safety – falls
	Less ice on lakes	Loss of tourism income and expense to re-flooding outdoor rinks	Unsafe ice fishing Unsafe ice skating on ponds and rinks Loss of iconic activities
Less severe winters	Bug cycles are not disrupted Less snow and ice on lakes allows weeds to grow year round	Expense to communities and states	
			Less frostbite

Appendix 1c: Temperature - Group Observations and Consequences

TEMPERATURE Both good and bad impacts to season changes.			
Group Observations	**Consequences of Temperature Changes**		
	Ecological	**Economic**	**Social**
Seasons are longer		MN farmland more valuable Construction is year round	
	Hardiness zone	Can grow new things	
	Range shift of traditional vegetation/habitat and animal and insect species. (shift is also related to the built environment)	Loss of native vegetation and species Loss of revenue from traditional businesses. Industry change.	
	New invasive species, more species and they survive longer	Cost to eradicate new invasive plant, animal and insect species. Usual pesticides are less effective. Drifting pesticide to other farms.	Aggressive pesticide use could harm humans
	Change/confusion in bird migration and animal hibernation patterns		
			Allergy, disease and other human conditions with a warmer climate.
Spring is earlier by one month		Construction and planting begins earlier Longer tourism season	Earlier swimming
Warmer earlier in the summer	Warmer lakes affect life in lakes Algae in the lakes		Poor fishing Poor lake quality for humans and animals
		More energy needed with associated increase in cost to cool homes, businesses manufacturing, and trucking Heat limits days working outside – can decrease in productivity and profit	High heat and humidity (heat advisory) days limits outdoor activity, sports and work. Heat related illness for elderly and others outside on high heat days.
	More water requirements	More water (expense and natural resource) needed for places like the golf course and home lawns.	
Fall is longer (One person said fall is shorter.)	Crops/vegetation grows longer	Longer work season for seasonal workers	
Atmosphere - **traps heat and humidity**	Agriculture contributes to higher humidity	Promotes plant growth Could affect machinery	
			Skin cancers, melanoma Sun feels more intense with higher humidity.
	Land fill contribute to GHG	Industry emissions	

Appendix 2: Barriers to Knowledge

BARRIERS TO KNOWLEDGE	
For Themselves	**For Others**
A. Information Aware there is a need to verify information, scrutinize source. Figuring out if it is good information. Fact versus fiction. Biased. Bad science. Are there political or economic motives driving a slanted viewpoint. Someone's agenda. Subject to author's entrenched beliefs: picking facts to fit case. Others must make sense of CC confusion for me because it is so complicated. Don't know enough about CC to engage with others. Too political – tune it out. Believing in CC. "Is that climate change? I don't know." When is it beyond normal variation? **B. Personal** 1. Lack of Time and Interest: Too busy with job, family, life… Having the time to sift through and engage with a complex subject. Doesn't occupy my attention. Other things would rather do. Government should deal with it not me. It doesn't seem urgent. 2. Lack of Skills: Having the computer skill and scientific knowledge to parse the volume of information to understand the real issues of climate change.	**A. Information** Not sure others have access to or can recognize reliable information. Overwhelming amount of information exists. Unable to sort out information to make decision or come to a wrong conclusion. Trust in False information. Access to accurate information. Information is published that is funded to manipulate, discredit, and confuse the science. Information exists that denies CC exists. Mixed messages. Access to internet. **B. Cultural** (*Lifestyle or Group Belonging*) Entrenched beliefs and opinions of self, family and friends. Have the willingness to listen to other's point of view (self-righteous). Cultural identification with motor sports. Not open-minded. The path of least resistance. Distance self from problem by political affiliations. Political foot dragging, ineffectiveness in getting legislation passed and denying. Change is inconvenient. Isolating your mind from it. Denying it. Not ready to say it is happening. Worried about just getting by. Busy with family and other activities. The individual is too small to make an impact. Don't value the environment. Not affected financially. No sense of urgency.

Appendix 3: Barriers to Action

BARRIERS TO ACTION	
Individual	Want to maintain **lifestyle** – comfort, habits, consumerism, motor and air travel. **Costs money** and takes **time/effort** to participate – day to day struggle to achieve work and life balance, understanding the overwhelming amount of confusing agenda strewn information, more convenient to stay ignorant or deny CC. Not ready to commit. Penalties for participation in programs. **Group belonging** - SES, job, political party, culture, or family contributes to lack of access to information or misinformation. Have to choose one side or the other. Government **- Anger** - don't want government regulation. Not enough options for the individual. **Fatigue** with politics.
Political	**Non-bi-partisanship** expert testimony and lobbying pits one side against the other. Intentional **misinformation** put out in the media, **not a world collaborator** - pulling out of Paris Accord, **mismatch** of environmental group agendas versus CC group agendas, balancing pressing world issues like housing, rights of the citizens, inability to provide accurate information and education for individual and industry. Regulations – **ineffective or non-existent** environmental, smart building or transportation or **non-uniform** state-to-state or community-to-community **interpretation** of codes, laws, and regulations, lack of incentives offered to participate.
Economic "Doesn't affect me and my business directly."	Free market versus science, like the status quo, jobs, who pays – one countries wealth is another countries woes. Cost of technology.
Positive CC in MN. Sense of non-urgency. Uncertainty.	

Appendix 4: Solutions for Broader Leadership

SOLUTIONS FOR BROADER LEADERSHIP	
GENERAL	
1. LEADERS (23)	**Want and expect a lot from our leaders.**
Education *"First of all they have to come to terms and all agree that that the science the science says that there is climate change and it's manmade."*	Stop the debate about climate change.
	Lead by example – show that sustainability costs less.
	Provide better information to the public
	Collaborate with school boards. Make CC real and accessible to students.
	Embrace education for girls and the underserved at home and worldwide.
Economics *"A new invention, a new technology, doesn't do anything unless it can be put into use in a big way."* *"I think I think that there's lots of money to be made in renewable energy and in climate development."*	Provide incentives or subsidies
	Make technology accessible faster and in a big way.
	Stop basing the economy on non-renewable consumables
	Balanced approach to divesting from non-renewables
	Invest in renewables
	Become less beholden to big money, lobbyists
	Bring jobs and food closer.
Legislation *"Limiting our carbon. Limiting pollution. Just trying to take care of what we have again."*	Pollution and emissions legislation
	Carbon cap and trade
	Make things easy for people from recycling to transportation.
	More environmental regulations: take a positive environmental stance on mining.
Collaboration > 30% said pulling out of the Paris Accord was a mistake.	Support global collaboration: for regenerative agricultural models; resume Paris Accord
	Long range planning
	Stop interdepartmental (scientists) fighting
	Collaborate with other states and regionally on sustainability issues.
2. ENGAGING EACH OTHER (22)	**Recognize the need for individual as well as collective action.**
"We want all these luxuries and all these other things but they all cost prices." *"Make the story real and personal."* *"Take collective responsibility for crisis we have caused."*	ENCOURAGE THE CONVERSATION while respecting rights. Need to get everybody to understand the issue so we can collectively find solutions. Talk about it on social media; at clubs and in churches; one to one; organize neighborhood conversations about climate change.
	How it affects the next generations.
	Become civically involved.
	Encourage others to be accountable for their action/inaction.
	Put differences aside, de-politicize issue.
	Model intentional deliberate choices.
	Provide physical participation with climate change: cleaning up the river, learning about solar power, collecting local climate data, and caring for the bees.
	Community level organizing and forums for information sharing with as many great minds as possible.
	Community level sharing of skills (technical and professional) and resources
SPECIFIC	
3. BUILT ENVIRONMENT (23)	**Recognize the need to change current practices -new or enforce existing regulation/legislation.**
"We can really manipulate the land and dictate our surroundings."	Use SMART building rules – build vertical, mixed housing use, infill vs. sprawl.

	US AI in a big way to improve efficiency.
	Use green technology
	Uniform codes to protect water: peat and sand filters to remove harmful items from wastewater; permeable papers; and permeable pavement.
	Enforce regulations to protect water (storm water and watershed): buffer zones, grass waterways with retention breaks, litigation or holding ponds and rain gardens.
	Continue with land and prairie restoration projects.
	Est. sustainability building codes: restore or repurpose vs. tear down and building new; require strengthening roofs to support solar technology; and passive heat/cool with ICF.
	Re-think building zoning near water and watershed; prepare buildings along the river to "float" with flooding; and find ways to "live" on the water.
	Establish uniform regulations (or make more stringent) for industry emissions and pollution; require industry to decrease footprint.
	Enforce existing legislation for all industry, businesses, and agriculture.
	Energy – see Energy
4. EDUCATION/Communication (17)	**Need for adequate, realistic information for all.**
	More research opportunities – federal or private Better flow of information sharing.
	Required CC education for people worldwide; for all students, pre-K through college, and citizens.
	Eliminate inaccuracies about climate change. Encourage telling the whole story – how what we do here has effects miles and continents away.
	Provide more opportunities to experience climate change – a year of experience
	Utilize local expertise from city, colleges, and individuals
	Direct education (hands on or experiential)
	Ramp up education opportunities in the sciences that will get us off non-renewable resources.
	Train communities members in emergency preparedness
	More spots on the news, in the newspapers, podcasts, better short scientific articles, on a local level information. SOCIAL MEDIA is a huge purveyor of information. EACH generation has its own special favorite means of communication/education.
5. ENERGY (16)	**Accelerate technology.**
"Must be transitioned carefully."	Energy suppliers should educate their customers and acquire regional energy. Provide home monitoring.
	Make technology accessible faster and in a big way.
"You have to take some sort of balanced approach to providing support and jobs to those people [working in non-renewable jobs], and at the same time, reducing our dependence on non-renewable resources."	Pursue renewable energy sources: roof top solar, solar gardens, wind, hydrologic, geothermal, LENR (cold fusion nuclear), waste wood.
	Be a leader in solar: Leaders should encourage renewable energy with subsidies; pass incentives for all to acquire renewable energy; and continue with tax credits for renewables.
	Eliminate the confusing language about what the real cost of renewable energy is.
	Continue energy efficiency and conservation.
	Experiment with communities producing their own power.
	Use artificial intelligence to regulate energy distribution and use, monitor pollution.
	Educate the public about renewable energy to reduce dependence.
	Emerging huge job market in renewables.
	Transition away from natural gas too (harmful methane).
6. TRANSPORTATION (7)	
	Comprehensive public transportation including train service.

"… create a big comprehensive public transit."	Artificial intelligence in cars. Use Greenwave technology on roadways.
	Help to advance battery-operated automobiles. Electric bicycles.
	Public education to get people out of their cars. Ration gas. Conscientious air travel.
7. AGRICULTURE (11)	
"Can be a huge part of the solution."	Widespread education about soil health
	Both traditional and organic farming needed
	Poultry-centered regenerative agriculture model
No-till method, "…puts carbon back in the soil where it should be…"	Provide education about tilling, tiling, buffer zones, fertilizer and pesticide use.
	Provide assistance: incentives and subsidies
	Manure management
	Conscientious spraying

Note: Italicized sentences in quotes are words taken directly from the interviewees.

Appendix 5: Northfield City Leader Solutions

SPECIFIC SOLUTIONS FOR THE CITY OF NORTHFIELD LEADERS		
Energy More **renewable energy** options: Rooftop solar, solar gardens, wind power, geothermal, use the river to generate energy. Have solar panels on the flat roofed buildings. Go solar as much as they can. More **energy efficiency** in existing buildings. Retrofit window, shades. Update building heating systems. Use high efficiency – LED. Regulate buildings using AI. Require uniform temperature settings. <u>Advocate/Educate</u> Collaborate with schools to experiment with river hydroelectric. Provide and support more options for community members to participate in energy efficiency programs like refrigerators. Make community-wide emissions data easily available to the community. <u>Legislation</u> Provide incentives for residential and business solar installation. Adopt policies that require using renewable energy. Better building codes to regulate energy (green or smart building). Require all new buildings or buildings being remodeled to be highly energy efficient, environmentally friendly like the high school. Get rid of the GHGs.	**Land Use (Built Environment)** <u>Advocate/educate</u> Educate and support manure management program. Educate about chemical use on lawns and in parks. <u>Legislation</u> Restrict use of chemicals on lawns or allow only certain services. Ensure replacement program for trees. Have watering bans. Keep parks special – no spray zone. Use permeable pavement on the streets. Change codes to allow for use of alternative materials on roads, parking lots, and driveways to prevent run off. Assist with flood protection is needed for buildings along the river. Clean streets more often to reduce runoff. Emphasize a human scale community – walking and biking. Insist on stewardship for our groundwater. **Consumption and Waste** <u>Advocate/educate</u> Reinforce education about recycling and garbage (waste). <u>Legislation</u> Require community-wide composting. Impose fines. More recycling options (plastics).	**Advocate/educate** Believe in the science to do the right thing for the community. Local action counts. Energy self-sufficiency should be possible. Lead by example. Be a leader. Policies to reduce pollution and poor farming practices. Make things easier – permits. Encourage smart decision-making. Affordable housing. Take the time to get the big picture. Partner more with colleges. Use the knowledge available in NFLD. Collaborate with schools to keep local climate records. Educate the community by holding more symposiums, forums, mail out information, put info in the newspaper, and place placards or informationals around town. **Transportation** <u>Advocate/educate</u> De-emphasize car culture, support less use of vehicles. <u>Legislation</u> Integrated transportation plan – ride share, buses, light rail. Restore passenger train service. Streets with more roundabouts, more accessible sidewalks and bike lanes. Roads should use AI for traffic flows. Provide charging stations for electric cars. City should acquire more hybrid vehicles.

APPENDIX 6: Individual Scores for the 11 Measures

	MINIMALS n=11											MODERATES n=10										MOST n=8							
Knowledge																														
1. Defining CC	2	0	2	0	3	2	0	1	1	1	2	1	3	3	3	3	1	1	3	3	2	1	3	3	2	3	3	2	3
2. Observations	1	2	2	2	3	3	1	2	3	1	1	3	2	1	3	2	3	3	2	2	3	1	2	2	3	3	3	3	3
3. Consequences	0	0	0	2	0	1	0	0	0	0	0	1	1	0	1	1	1	1	0	1	2	2	1	1	1	0	1	1	2
Action																														
4. Self Act Now	2	3	2	1	3	2	3	2	0	3	1	1	1	2	0	3	3	3	2	3	1	2	3	2	3	2	3	3	3
5. Self Act Later	0	1	1	0	2	2	1	2	1	2	1	1	1	0	0	2	0	2	1	0	1	1	1	2	2	2	1	1	1
Social Participation																														
6. Group BLNG	1	0	1	1	0	0	2	1	1	1	2	0	2	2	2	1	1	1	1	1	1	2	2	1	1	1	0	1	1
7. Trusted Source	0	0	0	0	0	0	0	0	0	2	2	2	0	0	2	0	2	0	2	2	0	2	2	0	2	2	0	2	0
8. Others Talk	0	0	0	0	0	0	1	0	1	1	m	0	1	0	m	1	0	0	0	0	2	2	0	1	0	1	2	1	1
9. City Act Now	2	1	0	1	0	0	2	1	2	1	0	2	1	3	m	0	2	3	2	2	1	0	1	3	2	1	2	3	3
Solutions																														
10. City Act Later	m	1	1	2	1	1	1	2	1	1	2	3	1	2	2	2	1	1	2	1	2	3	1	2	2	2	3	3	3
11. Broad Leader	2	2	2	2	1	2	2	2	3	1	3	2	2	2	3	2	3	2	3	3	3	3	3	2	2	3	3	3	3
GRAND TOTAL	10	10	11	11	12	13	13	13	13	14	14	15	15	15	16	17	17	17	18	18	18	19	19	19	20	20	21	23	23

1. Defining CC: 0 = uncertain; 1 = 1 weather or weather variable or anthropogenic; 2 = weather and variable; 3 = define and anthropogenic causes.

2. Observations: 1 = 1 observation (winter, temperature, and precipitation); 2 = 2 observations; and 3 = 3 observations.

3. Consequences: 0 = 0-7 observations (ecological, economic and social); 1 = 8-14 observations; 2 = 15 and above observations.

4. Self Act Now: 0 = 0 categories (energy, transportation, consumption and waste, land, or advocacy/education energy); 1 = 1 cat.; 2 = 2 cats.; 3 = 3 or more cats.

5. Self Act Later: 0 = 1 categories (energy, transportation, consumption and waste, land, or advocacy/education); 1 = 2 cats.; 2 = 3 or more cats.

6. Group BLNG: 0 = 0 -1 category; 1 = 2 cats.; 2 = 3 or more cats.

7. Trusted Source: 0 = media; 2 = science.

8. Others Talk: 0 = no, not much; 1 = some; 2 = a lot.

9. City Act Now: 0 = none.; 1 = delayed response; 2 = 1- 2 categories(energy, transportation, consumption and waste, land, or advocacy/education); 3 = 3 or more categories.

10. City Act Later: 1 = 1 category (energy, transportation, consumption and waste, land, or advocacy/education); 2 = 2 cats.; 3 = 3 or more cats.
11. Broad Leader: 1= 1-2 categories.; 2 = 3-4 cats.; 3 = 5 or more cats. Categories emerged as better leadership, engaging others, better land use and building practices, more education, transition to other energy sources, create a comprehensive public transportation system, and use the best agricultural practices.