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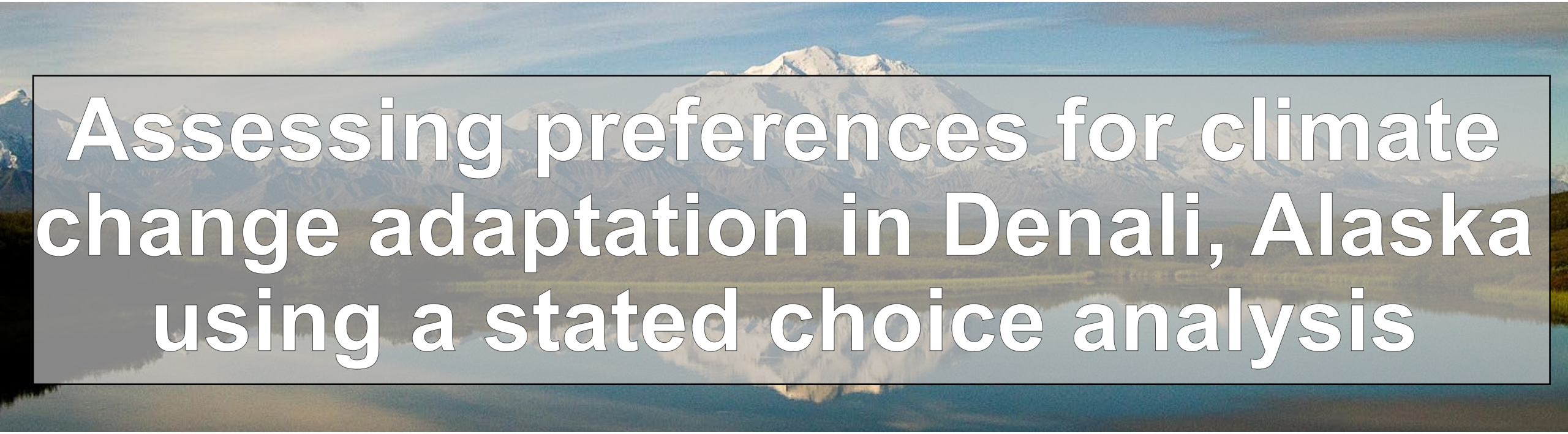

Assessing preferences for climate change adaptation in Denali, Alaska using a stated choice analysis

Dana N. Johnson[1]

Carena J. van Riper[1]

[1]*University of Illinois at Urbana-Champaign, Department of Natural Resources and Environmental Sciences*

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Climate Change in Protected Area Systems

- **Global environmental change is challenging traditional protected area management paradigms (Díaz et al., 2019; West et al., 2009)**
  - PAs and surrounding communities have been experiencing **rapid and unprecedented change**
  - Especially true at higher latitudes such as **Interior Alaska**

- **Decisions about the future of these landscapes involve tradeoffs that underscore the significance of including diverse stakeholder perspectives, including local communities**

- **Identifying distinct visions is integral for overcoming common challenges in protected area management to adapt to climate change impacts including:**
  - Lacking common visions and support among local, regional, and national governments (Blondet et al., 2017)
  - Difficulties in balancing conservation goals with economic and social drivers (McCauley et al., 2008)

Choice Modeling

- **Choice experiments are effective tools for evaluating preferences for the future**
  - *Choice is* made based on theory of utility maximizations (McFadden, 1974)
  - Characterized by at least two options (i.e., alternatives) that include attributes held at various conditions or levels (Louviere et al., 2000)
  - Respondent preferences are elicited by choosing between two paired comparisons

- **Based in econometrics, but increasingly applied to natural resource and environmental management contexts (Foelske et al., 2019; Liski et al., 2019; Norden et al., 2017 Spyce et al., 2012)**

Effect of Restoration	Current Situation (no restoration)	Restoration Project A	Restoration Project B
Fish Habitat	0% 0 of 4347 river acres accessible to fish	5% 225 of 4347 river acres accessible to fish	20% 900 of 4347 river acres accessible to fish
Population Survival Score	0% Chance of 50-year survival	30% Chance of 50-year survival	30% Chance of 50-year survival
Catchable Fish Abundance	80% 116 fish/hour found out of 145 possible	70% 102 fish/hour found out of 145 possible	70% 102 fish/hour found out of 145 possible
Fish-Dependent Wildlife	55% 20 of 36 species native to RI are common	80% 28 of 36 species native to RI are common	60% 22 of 36 species native to RI are common
Aquatic Ecological Condition Score	65% Natural condition out of 100% maximum	70% Natural condition out of 100% maximum	80% Natural condition out of 100% maximum
Public Access	Public CANNOT walk and fish in area	Public CANNOT walk and fish in area	Public CAN walk and fish in area
$ Cost to your Household per Year	$0 Increase in Annual Taxes and Fees	$15 Increase in Annual Taxes and Fees	$25 Increase in Annual Taxes and Fees
HOW WOULD YOU VOTE? (CHOOSE ONE ONLY)	☐ I vote for NO RESTORATION	☐ I vote for PROJECT A	☐ I vote for PROJECT B

Johnson & Ramachandran (2014). *Environmental Resource Economics*

Choice Modeling for Visioning

- **Growing need to understand the priorities of distinct stakeholder groups and residents surrounding protected areas in the face of climate change (Blondet et al., 2017; McCauley et al., 2008)**

- **With rapid and unprecedented change, stakeholders' priorities for their futures need to be assessed and tradeoffs must be evaluated**
  - Analyzing preferences at a **regional scale** is largely unprecedented and important for preparing residents for their futures
  - Research applying choice modeling to **climate change** related issues is nascent, but can be useful for decision-makers to identify key **visions** for a landscape

Research Objective

In this study we use a discrete choice experiment to elicit Interior Alaskan residents' preferences for future landscape change in the face of regional climate change impacts. This experiment is useful for identifying areas of public interest and concern.

- Our objective is to assess the effects of study attributes – moose population, off-season tourism, acres managed for fire, length of winter, and annual cost – on preferences for the future



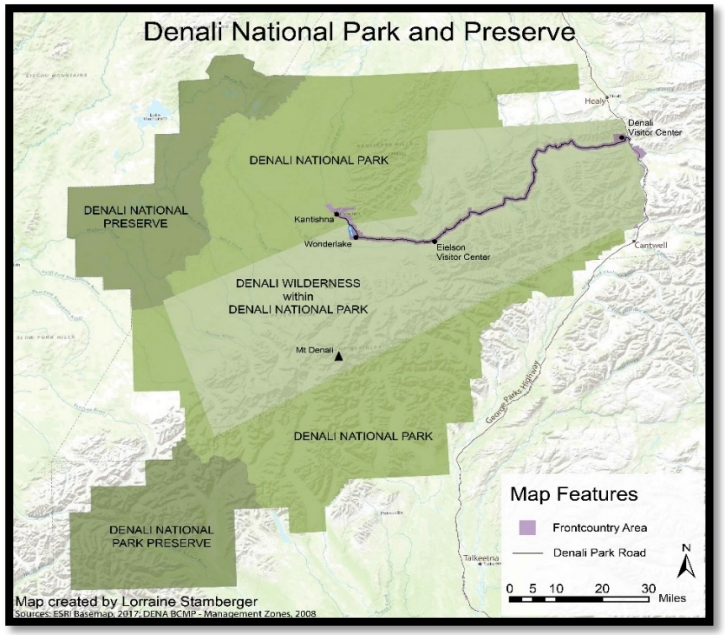

Study Context

- **Denali National Park and Preserve**
  - Located in the Alaskan interior and home to highest peak in North America: Mt. Denali (20, 310')
  - Mixture of deciduous taiga forest, tundra, glaciers, snow, and bare rock at varying elevations
  - Established wilderness within park boundaries
  - Renowned for charismatic wildlife and vast, undeveloped landscapes

View of Mt. Denali from inside the park

Taiga forests in low elevations of the park

- **Primary drivers of change that are manifesting impacts being observed and experienced by local residents**
  - Weather patterns
  - Hydrology
  - Vegetation

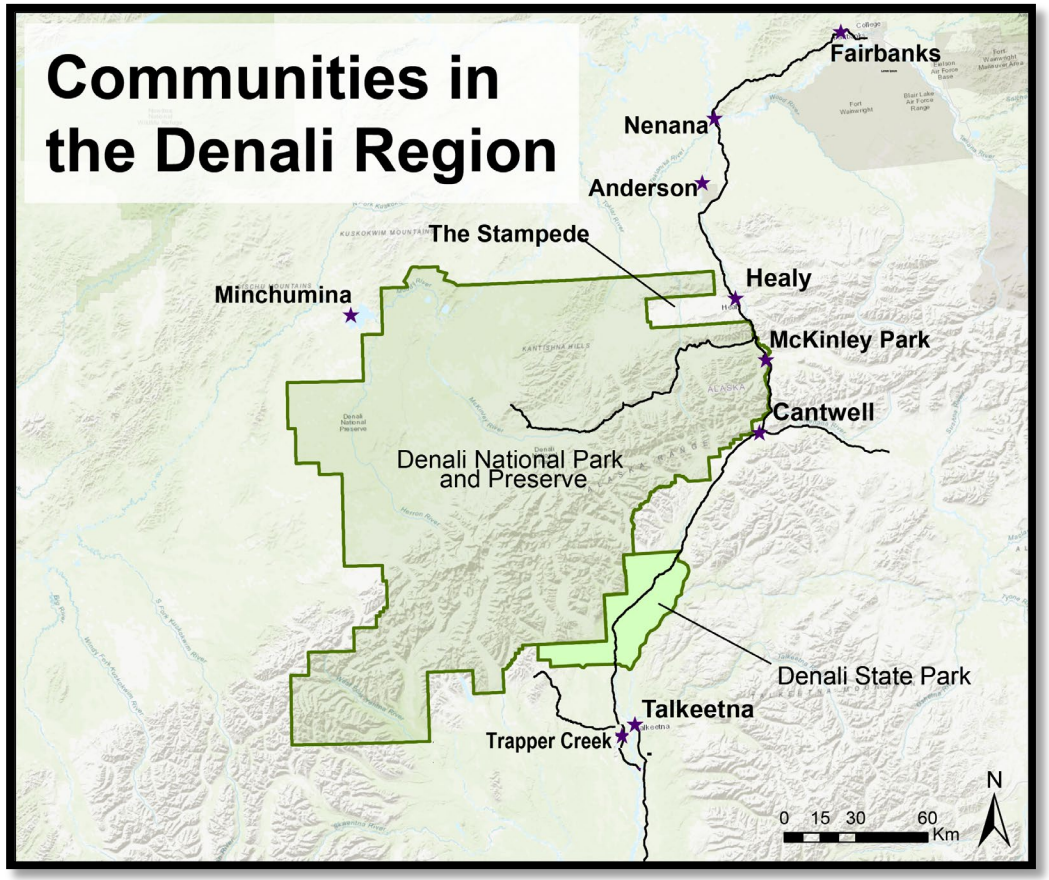


Study Context (cntd.)

- **Communities between Talkeetna and Fairbanks on or near the George Parks Highway – Interior Alaska**

- **Includes several interest groups with distinct priorities for the future**
  - Conservation
  - Education
  - Energy (i.e., coal, wind, solar)
  - Military
  - Local business
  - Tourism

- **Primary decision-making entities include public land management, natural resource, and wildlife management agencies**



Study area that includes key communities along the George Park's Highway

Development of Choice Experiment

- **Used scientific reports and qualitative data to identify relevant attributes and levels**
  - Informal meetings (n = 100)
  - Semi-structured interviews (n = 38)
  - Focus groups (n = 7)
- **Identified most relevant changes as a result of climate change likely to occur in the next 30 years**
- **Received feedback from key leaders in the community representing main interest groups**

Attribute	Description	Levels
1. Moose population 	The amount of moose in Interior Alaska	Maintain current population Increase by 15% Increase by 30%
2. Off-season tourism 	The growth rate of visitation to Interior Alaska during the off-season months (October-April)	Increase by 25% Increase by 35% Increase by 45%
3. Acres managed for fire 	Acres of forest in Interior Alaska protected by public land management agencies	Maintain current acres Increase by 15% Increase by 30%
4. Shorter winters 	The amount of days in the winter season	0 days shorter 7 days shorter 14 days shorter
5. Annual cost 	The amount of money paid from annual dividend residents receive from the state each year (Alaska Permanent Fund)	$0 $25 $50 $75 $100

Development of Choice Experiment

- **Developed experimental design using NGENE software**
  - Resulted in 18 total paired comparisons
  - Each respondent evaluated 9 out of 18 paired comparison (i.e., 2 blocks of 9)

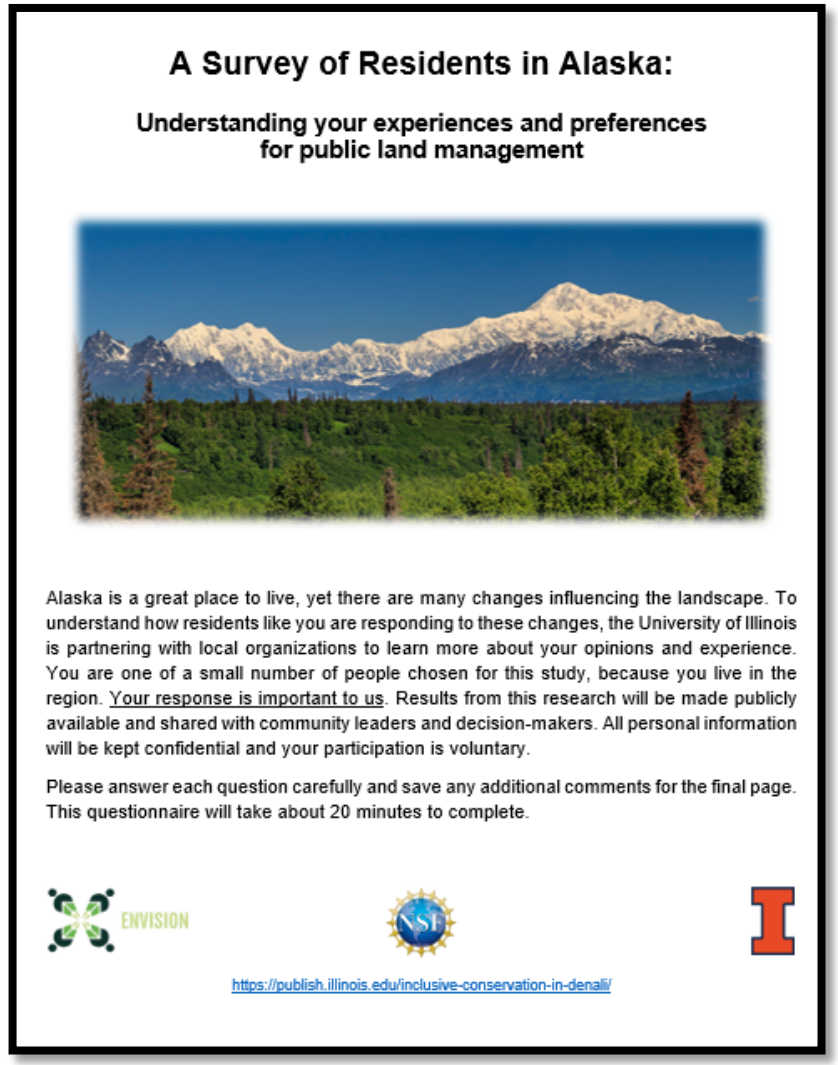
Future Scenario 1

Suppose Option A and Option B were the *only* options available besides "No change" over **the next 30 years**. Which would you choose? *Please check the box that represents your choice.*

Attribute	Moose population	Acres Managed for Fire	Off-season Tourism	Shorter Winters	Annual Cost	I would choose
Option A	15% Increase	0% increase in acres managed	45% growth rate	7 days earlier	$50	❒ A
Option B	0% increase	30% increase in acres managed	35% growth rate	7 days earlier	$50	❒ B
Option C	No change					❒ C

Pilot Survey Administration

- **Pilot survey administered to residents of Fairbanks using a Qualtrics panel in April 2020 (n = 28)**
  - Sampled from 10 zip codes considered part of Interior Alaska
- **Descriptive statistics used to assess**
  - Socio-demographics
  - Experience use history
- **Factor analysis used to confirm hypothesized dimensions of attitudes toward attributes included in the stated choice model**



A Survey of Residents in Alaska:

Understanding your experiences and preferences for public land management

Alaska is a great place to live, yet there are many changes influencing the landscape. To understand how residents like you are responding to these changes, the University of Illinois is partnering with local organizations to learn more about your opinions and experience. You are one of a small number of people chosen for this study, because you live in the region. Your response is important to us. Results from this research will be made publicly available and shared with community leaders and decision-makers. All personal information will be kept confidential and your participation is voluntary.

Please answer each question carefully and save any additional comments for the final page. This questionnaire will take about 20 minutes to complete.

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https://publish.illinois.edu/inclusive-conservation-in-denali/

Analysis of Discrete Choice Data

- **Choice data were analyzed using a multinomial logit model (MNL)**
  - The 'workhorse' of choice models
  - implemented widely by researchers (Louviere et al., 2000)
  - Stringent assumption that error is independent and identically distributed (IID)

- **Random Parameters logit model (RPL) was also estimated, though the output was not considered due to implications of using RPL parameters to estimate an efficient design with a small sample size**
  - Model coefficients vary across the sample by treating them as random (Hunt, 2005)
  - Relaxed the assumption that error is independent and identically distributed (IID)

- **Analysis was conducted in NLOGIT Version 6**

Descriptive Results

- **Respondent demographics (n = 28)**
  - 38.9% Male; 61.1% Female
  - Ages ranged from 18-70; *M* = 34.0 (SD = 16.1)
  - 50% white, 8.3% Alaska Native, 8.3% Black; 8.3% Asian, 2.8% pacific Islander, 5.6% other
  - Education (33.3% holding at least a college degree)
  - Average household income between $25,000-$49,000

- **Respondents lived in Alaska for an average of 16.42 years (SD = 14.36)**

- **Most respondents have visited public lands in Alaska**
  - 69.7% visited Denali National Park and Preserve at least once; *M* = 4.18 times (SD = 7.76)
  - 78.8% visited public lands in Alaska at least once; *M* = 16.76 times (SD = 26.05)
  - 66.7% visited public lands in Alaska in the last year; *M* = 3.61 times (SD = 5.32)

Model Results

- **Odds of choosing an alternative increased with increases in acres managed for fire**
  - Odds also increased with increases in moose population, though this was non-significant
- **Odds decreased with increases in willingness to pay**
  - Odds also decreased with increases in off-season tourism and shorter winters, though these relationships were non-significant

Attributes	Coefficient (SE)
Moose Population	0.007 (0.006)
Acres Managed for Fire	0.015** (0.006)
Off-season Tourism	-0.002 (0.009)
Shorter Winters	-0.013 (0.011)
Willingness to Pay	-0.004** (0.002)

LL = -226.59; AIC = 465.2 ; N = 252; Pseudo R^2 = 0.0009; Significance at 5% = **

Discussion

- **Residents in Interior Alaska respond favorably to future scenarios with:**
  - More acres managed for increasing fires
  - Require less money spent from their annual dividend
- **It could be that residents were responding to the most prominent impacts in the region**
  - In 2019, Alaska experienced an extreme fire season due to increased temperatures and less frequent precipitation
  - 719 fires, burning 2,589,893 acres (Alaska DNR, 2020)
- **Residents are not willing to donate portions of their annual dividend for the Alaska Permanent Fund**

Photos from Interior Alaska, summer 2019 during extreme fire events

Discussion

- **Though non-significant, results also indicated that residents respond favorably to future scenarios with:**
  - Larger moose populations
  - Less off-season tourism
  - Longer winters

- **While projections of climate change impacts in Interior Alaska are apparent in scientific reports, these implications may not be recognized or prioritized by residents**
  - Impacts can be uncertain, indirect, or have delayed effects
  - To respond to residents' preferences, decision-makers could focus efforts on increasing the amount of acres that are protected from wildfires

Future Directions

- Coefficients from the pilot MNL have been used to re-estimate a Bayesian Efficient Design for the final model
- Final survey administered late June to 3,000 residents living on or near the George Parks Highway in Interior Alaska
- Explore variation in preferences for the future by segmenting population by environmental attitudes

Acknowledgements

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Principal Investigators
Dr. Carena J. van Riper (Principal Investigator)
Dr. William P. Stewart (Co-Principal Investigator)

Key collaborators
Dr. Rose Keller
Dr. Christopher Raymond
Dr. Marc Metzger
Erik Johnson
Amy Craver

Graduate Students
Evan Salcido
Elizabeth Golebie
Nathan J. Shipley
Seunguk Shin

Postdoctoral Scholars
Dr. Riley Andrade

Research Technicians and Undergraduate Students
Ruth Colianni
Gillian Rowe
Cynthia Segura
Gina Fumagalli
Haley Ware
Kimmy Chuang
Gina Delascio
David Nguyen

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Thank you for your attention!

dnjohns2@illinois.edu
@johnson_dn