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B-1407
August 2025

University of Wyoming | College of Agriculture, Life Sciences and Natural Resources

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Editor: Maya Gilmore, University of Wyoming Extension
Designer: Jeremy Cain, University of Wyoming Extension
Cover Image Generated with Dream.ai

This material is based upon work supported by the National Science Foundation under Award No. OIA 2149105. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Issued in furtherance of extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Mandy Marney, Director, University of Wyoming Extension, College of Agriculture, Life Sciences and Natural Resources, University of Wyoming Extension, University of Wyoming, Laramie, Wyoming 82071.

Tourism is the second largest economic sector in Wyoming (Jackson Hole Travel and Tourism Board 2023). In 2021 outdoor recreation and tourism accounted for roughly 4% of the state's GDP (Bureau of Economic Analysis 2023). Travelers to Teton County specifically spent $1.7 billion in 2022, while supporting 7,890 jobs (JHTTB 2023).

As a subset of tourism, angling generates millions of dollars of income for Teton County each year and supports several hundred area jobs directly and indirectly (Loomis 2005).

Teton County, located in northwestern Wyoming, is situated in the headwaters of the Snake River Basin (Figure 1). We refer to this portion of the Snake River Basin, centered in Teton County, as the Snake River headwaters.

Researchers anticipate that climate change will affect the area's angling industry in the coming decades. Peak runoff from snowmelt is expected to happen earlier in the year, lowering water levels and increasing water temperatures during the summer (Hostetler et al. 2021). These changes put native trout populations at risk (Al Chokhachy et al. 2021; Cline et al. 2022). Wildfires are also projected to happen more often in coming decades, leading to impacts such as decreased air quality, travel difficulties, road closures, obscured scenery, and evacuations (Hostetler et al. 2021).

Given the importance of tourism, and the potential for climate to impact this sector, researchers at UW are studying how future conditions will impact the state and its economy as part of the Wyoming Anticipating Climate Transitions (WyACT) project. The WyACT project goal is to help people in Wyoming adapt to changing climate conditions.

As part of the WyACT effort, we conducted research to understand how angler spending and preferences may change in the future given potential changes in climate. We conducted a survey of anglers who fished in Teton County from August 2022 through August 2023. This survey examined how angler decision-making and spending may change under potential future scenarios developed by other WyACT researchers (De Figueiredo, forthcoming).

We cannot know which climate scenario will come to pass, but these survey results could help decision-makers prepare for different possible futures. This bulletin describes the survey and key implications.

SURVEYING TETON ANGLERS

The survey was developed through a combination of expert interviews, literature review, and focus groups. Focus groups consisted of anglers in the Snake River headwaters, with a broad range of experience and expertise.

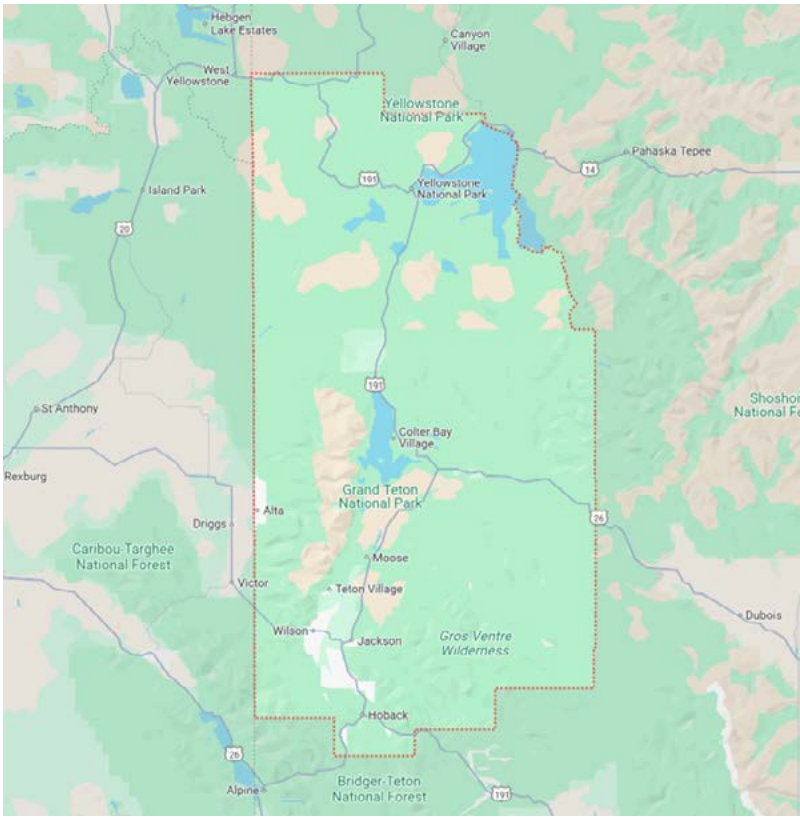

Figure 1. Teton County, Wyoming, situated in the headwaters of the Snake River basin

WyACT researchers met with area residents to understand their concerns and expectations about what changes in temperature and precipitation could mean for the Snake River headwaters. These discussions about potential changes in temperature and precipitation were based on climate projections for the region (Hostetler et al. 2021). This process resulted in three potential future scenarios for the Snake River headwaters. In the "Shrinking Snowpack" scenario, snowpack will be lost in coming decades, impacting water temperatures and when runoff occurs in the area. The "Warm Refuge" scenario imagines that the Snake River headwaters will be less impacted by climate change than other popular Western recreation destinations, leading to an increase in tourism for the area. Finally, the "Hot and Smoky" scenario projects more wildfires and increasing temperatures in the area in the coming decades. These projections represent different potential scenarios of climate change, none of which are guaranteed to come to pass.

Given these general climate scenarios, we conducted focus groups with anglers to understand their concerns about how angling experiences could be impacted in the Snake River area. Focus groups consisted of anglers in the Snake River headwaters, ranging from beginners with virtually no fishing experience to lifelong anglers and professional outfitters. They were asked various questions related to the relative importance of different fishing trip characteristics. These focus group

Table 1. Future Scenarios and Associated Fishing Trip Characteristics

Scenario	Main Features	Associated Trip Characteristics
Shrinking Snowpack	Decrease in snowpack, earlier peak runoff, temperature increases	Number of fish and fish species
Warm Refuge	Temperature increases, increased tourism	Access and angler crowding
Hot and Smoky	Temperature increases, increases in wildfire, increases in wildfire smoke	Air quality and scenery

results link specific fishing trip components to the potential climate scenarios (Table 1).

Through these methods, we identified aspects of a Snake River headwaters fishing trip that could change in response to changing climate conditions: number of fish caught, fish species in waterways, presence of smoke, crowding, access to fishing sites, and cost.

In the survey, anglers were asked to choose which of two hypothetical trips they would prefer to take. They could also choose neither trip.

Each angler was asked to make five different trip choices between two hypothetical fishing excursions. Trips varied by component quality (see Figure 2 for a sample question). These choices were aggregated across respondents to understand which components of a fishing trip are valuable to Teton County anglers.

Anglers were also asked how much money they spent on different aspects of their trip (lodging, food, supplies, etc.), as well as demographic questions to get a sense of the current anglers fishing in the Snake River headwaters.

Once the survey was developed, 5,000 individuals who purchased a fishing license in the state of Wyoming during 2023 were sent an invitation to take the survey. We divided the invitations between those who purchased licenses online versus in person. Within each group of purchasers, we further divided the invitations to balance in-state versus out-of-state residents. We matched the number of invitations to each category to be proportional with the total number of people in each category in the state.

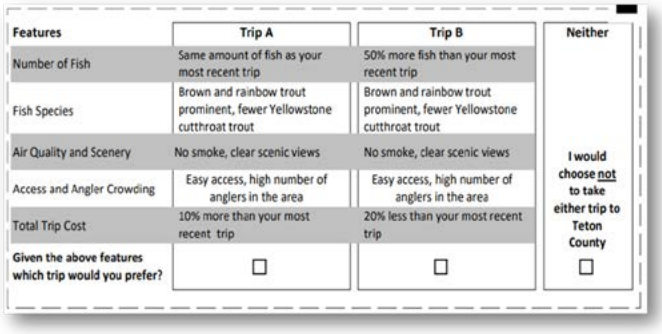

Figure 2: A sample question from the survey

Survey respondents could complete the survey by hand and mail it back or complete it online. Respondents indicating they had taken a fishing trip in the Snake River headwaters that year comprised the data used for our analysis.

TETON ANGLER DEMOGRAPHICS AND PREFERENCES

In total, we received 771 responses to the survey. Of those 771, 323 respondents indicated they had fished in our study area over the previous year. 81 of these respondents were Wyoming residents, while 242 were out of state residents. The results provide a picture of the average Snake River angler, and how their decision-making may change in the future. Some interesting survey respondent characteristics follow:

- Average age: 55 years old
- Average annual income: $242,015
- Percent of respondents who are not Wyoming residents: 75%
- Percent of male respondents: 85%
- Average respondent self-rating as an angler (1–5, 5 being the best): 3.46
- Percent of respondents with a bachelor's degree or higher: 72%

Additionally, we asked respondents to rate their preferences toward a fishing trip in the Snake River headwaters. These questions took the form of Likert scale questions, asking respondents to rate the importance they place on different aspects of a fishing trip on a scale of 1 to 4 (1 being not important, 4 being very important). Responses to these questions are displayed in Figure 3.

Survey respondents rated "Viewing a scenic landscape" and "Feeling solitude while I fish" as their most important trip components. Respondents rated "Taking a trip close to home" and "Sharing a fishing spot with knowledgeable anglers" as the least important trip components.

We cannot assume that every angler in our study has the same fishing trip preferences. To find out if groups existed within our respondents, we ran additional statistical analyses that sorted respondents into two different groups based on their preferences about smoke, access to angling spots, proximity to home, and residency status. Including trip preferences improved our model's fit when compared to splitting the population based on residency alone. These two groups had different spending habits and trip preferences. It's also likely they will respond to different ways to future climate changes in the Snake River headwaters.

We generally characterize the two different groups of anglers in Teton County headwaters as the "Nature Lovers" and the "Friendly Neighbors." The Nature Lovers make up about 56% of survey respondents. In general, the Nature Lovers:

- Were less likely to prefer taking trips close to home
- Were more interested in avoiding wildfire smoke and other anglers
- Were less likely to care about easy access to fishing spots
- Were less likely to be Wyoming residents

The Friendly Neighbors make up about 44% of survey respondents. In general, they:

- Cared more about taking a trip close to home
- Were less likely to care about avoiding wildfires or other anglers
- Were more likely to care about having easy access to fishing spots
- Were more likely to be Wyoming residents.

The two groups also differed in their spending habits. Table 2 records the average expenditures by category for each of the angler groups. The Nature Lovers spent nearly $500 more per trip than the Friendly Neighbors. The Nature Lovers tended to spend more money in all categories—especially travel and lodging—than the Friendly Neighbors. This reflects that Nature Lovers tended to be non-resident anglers with higher incomes who traveled greater distances for the experience of fishing for Snake River fish, particularly cutthroat trout.

The two groups also had different concerns about the future scenarios (Table 4). The Nature Lovers placed high importance on avoiding wildfire smoke and other anglers. They were less bothered by increased difficulty accessing fishing sites. Results indicate Nature Lovers will take 12.6% fewer trips and reduce expenditures by almost $7 million in the Hot and Smoky scenario

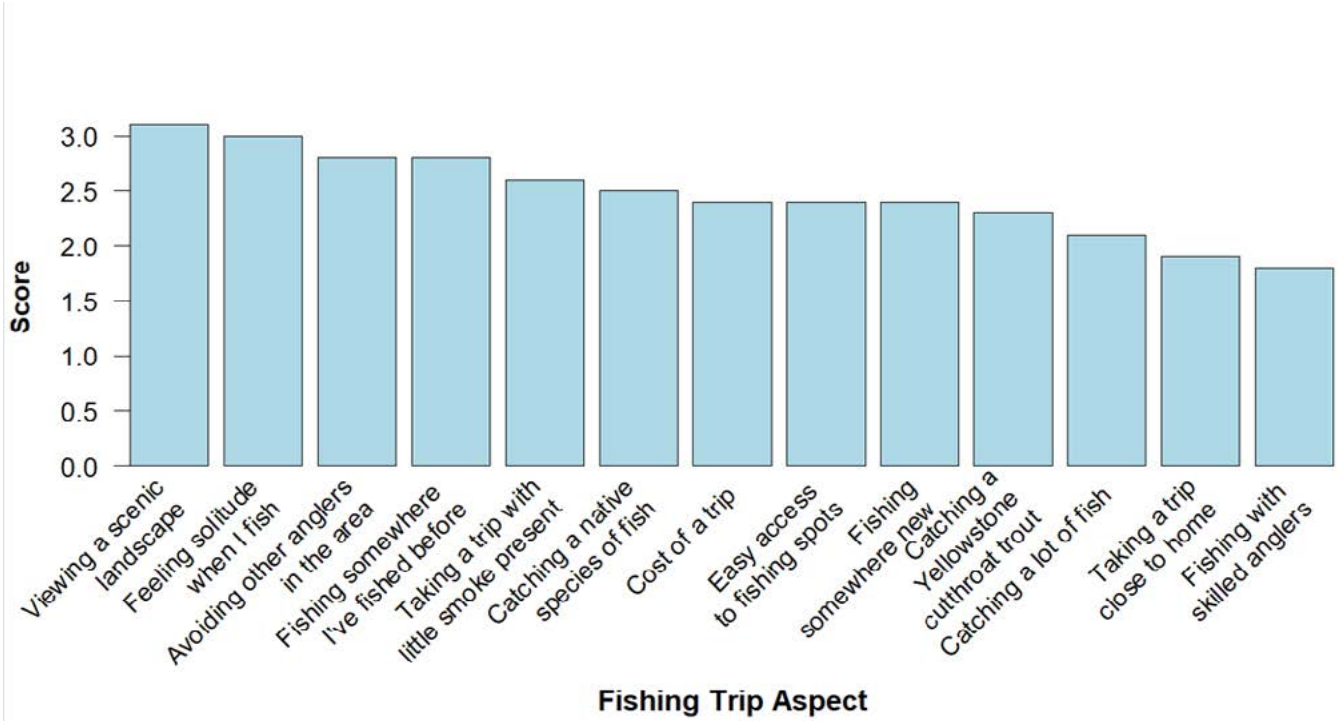

Figure 3: Average importance placed on different aspects of a fishing trip by Teton County anglers (1 being not important, 4 being very important)

and by 11% and over $6 million in the Warm Refuge scenario. These were by far the largest impacts found in the study.

In contrast, the Friendly Neighbors changed their fishing trips and expenditures less dramatically than the Nature Lovers in response to changes in the quality of the fishing experience.

The Friendly Neighbors decreased the number of trips taken by 3% in the presence of wildfire smoke, which was far less than the Nature Lovers. Nonetheless, the reduction in expenditures by the Friendly Neighbors group is estimated to be over $1 million for increased wildfire smoke.

The Friendly Neighbors did not place as much importance on avoiding other anglers. They changed trips by less than 1% when angler presence changed. Overall, the Friendly Neighbors are more adaptable to change than the Nature Lovers, and more likely to return to Teton County even if fishing experience quality decreases.

Both groups are projected to take fewer trips if the population of Yellowstone cutthroat trout decreases. Nature Lovers trips decrease by roughly 6%, resulting in over $3 million in lost expenditures. Friendly Neighbors trips decrease by over 2%, with a resulting loss of over $800,000 in expenditures. This represents the second largest magnitude of loss in trips for the

Table 2. Travel Expenditures by Angler Group

Expenditure Category	Nature Lovers (56%) (in $US)	Friendly Neighbors (44%) (in $US)
Travel	455	367
Lodging	1,106	739
Angling Related	467	433
Other	668	681
Total	2,696	2,220

Table 3. Projected Changes in Trips Taken and Expenditures Based on Fishing Experience Change

	Projected Trips	% Change in Trips	Expenditures (US$ millions)	Difference in Expenditures (US$ millions)
Group #1-Nature Lovers	46,922		55.47	
...with smoke and obscured views	41,010	-13%	48.48	-6.99
...without difficult access, fewer anglers	41,667	-11 %	49.26	-6.21
...with fewer Yellowstone cutthroat trout, more brown and rainbow trout	44,215	-6%	52.27	-3.20
...with more fish	49,949	6%	59.05	3.58
...with fewer fish	45,388	-3 %	53.66	-1.81
Group #2-Friendly Neighbors	36,718		35.46	
...with smoke and obscured views	35,532	-3 %	34.31	-1.15
...without difficult access, fewer anglers	36,887	0.5%	35.62	0.16
...with fewer Yellowstone cutthroat trout, more brown and rainbow trout	35,888	-2 %	34.66	-0.80
...with more fish	38,091	4%	36.78	1.32
...with fewer fish	35,947	-2 %	34.71	-0.75

Friendly Neighbors. This change, as noted in Table 1, is primarily associated with the Shrinking Snowpack scenario.

Based on these results, we expect that a Hot and Smoky future scenario may cause the highest losses to the angling industry in Teton County. Fewer cutthroat trout would have a bigger negative impact on angling than fewer trout in general. While the other scenarios might have less impact on expenditures, all three of the scenarios would result in some losses to the angling industry.

RECOMMENDATIONS BASED ON THE SURVEY

We can draw several policy implications from the study results. First, more wildfire smoke will have a negative impact on the number of trips anglers take to the area. Area stakeholders should expect decreased visitation and recreation spending with respect to angling with prevalent wildfire smoke.

People in the angling industry could consider diversifying recreational opportunities in order to mitigate associated losses. This could include promoting angling trips that venture to less smoke impacted areas or trying to market trips in months with lower likelihood of wildfire smoke. The cost of trips further away from smoky areas may be higher, but study results suggest anglers would be willing to pay more for a smoke free experience.

Second, any infrastructural expansions and projects aimed at distributing recreational pressure that make access to fishing sites easier should consider potential losses in angler trips from the Nature Lovers group, who tend to value isolation and are not bothered by remote, difficult to access fishing sites. Increased visitation and recreation expenditures from infrastructural improvements will be to some extent offset by a decrease in Nature Lover trips and expenditures.

Finally, efforts to maintain Yellowstone cutthroat trout populations should continue at current levels or even increase. The Nature Lovers and Friendly Neighbors both viewed a decline in Yellowstone cutthroat population as a negative. While neither group saw this as the most important feature of their fishing trip, maintaining a healthy cutthroat trout population could mitigate losses that occur due to other climatic conditions, such as increased wildfires. Further promotion of cutthroat and other target native species could also mitigate losses from other future conditions. Efforts taken to improve cutthroat and general trout populations overall should be addressed in marketing efforts to anglers.

Flows on the mainstem of the Snake River between Jackson Lake Dam and the Idaho border are currently maintained at minimum levels designed to help the Yellowstone cutthroat trout population. If we find ourselves in a warmer, drier future, it may be more difficult to maintain flows during winter months, when the fishery needs it most. Future work will quantify the economic value of the Snake River cutthroat trout fishery, to better understand tradeoffs between Idaho agricultural and Wyoming recreation uses of Snake River water.

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