Envisioning the future: Photorealistic representations of Greater Yellowstone landscapes in a warmer world with more fire

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Background/Questions: Conveying to people the nature and magnitude of future ecological transformations driven by anthropogenic climate change is an urgent science communication challenge. A future that differs drastically from the known past is difficult to envision, especially in forested landscapes. Forest change is slow relative to human lifespans, and the presence of mature stands can mask the rising potential for transformative change. In this study, we translated published results from a simulation study projecting the future of iconic forested landscapes in Greater Yellowstone in a warmer world with more fire (Turner et al. 2022, Ecol. Monogr.) into photorealistic visualizations. Our goal was to convey potential effects of climate-driven change in a landscape known and loved worldwide and to quantify the reaction of visitors to these potential futures. We asked (1) whether viewing the images altered perceptions of climate change across demographic groups, and (2) whether visitors had preferences among future landscapes that varied in their magnitude of change.

Methods: Photographs were taken in summer 2022 from prominent scenic locations in Yellowstone and Grand Teton National Parks. Images were digitally modified to depict late-21st century forests as simulated by the forest landscape model iLand under a warmer (RCP4.5, less change) and hotter (RCP8.5, more change) future with the HadGEM2-ES global climate model. We surveyed 398 visitors (56% response rate) in both parks during summer 2023 and used Likert scales to assess responses.

Results/Conclusions: Visitors' perception of climate change effects increased substantially after viewing the images and was unaffected by age or income. Notably, perception increased similarly for visitors who self-identified as conservative or liberal, indicating that visualizations were effective across the current political divide. The increase in perception of climate change effects was different between visitors with associates/bachelor's degrees vs visitors with terminal degrees, with stronger increases for visitors with associates/bachelor's degrees. In images that were primarily forested, visitors strongly preferred current vs. future landscapes with either warming scenario. If images also included landmarks such as mountains or thermal features, visitor preference for current vs. future landscapes was less pronounced with moderate warming scenarios. Participants' reasons for visiting the GYE did not correlate strongly with preference for either warming scenario, but greater preference for current vs hot future scenarios weakly correlated with the importance of "listening to nature" (Spearman's $\rho = 0.24$, p-value < 0.001, $n = 398$) and "seeing vast forest" (Spearman's $\rho = 0.23$, p-value < 0.001, $n = 398$). Results suggest that stabilizing atmospheric greenhouse gas concentration will help sustain some important cultural ecosystem services in protected areas. Visual communication is a powerful tool for conveying the magnitude of projected climate change, particularly in iconic landscapes where emotional connections to nature may enhance resonance. This approach offers a replicable framework for communicating complex modeling results and highlights the potential of visual communication in enhancing public understanding of climate change effects.

I am a PhD Student in Dr. Monica Turner's group at the University of Wisconsin-Madison. My research addresses the effects of climate change on fire, postfire tree regeneration, and ecosystem function in forests of the Greater Yellowstone Ecosystem. I am passionate about translating research findings into management strategies that benefit ecosystems and the people within them.
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