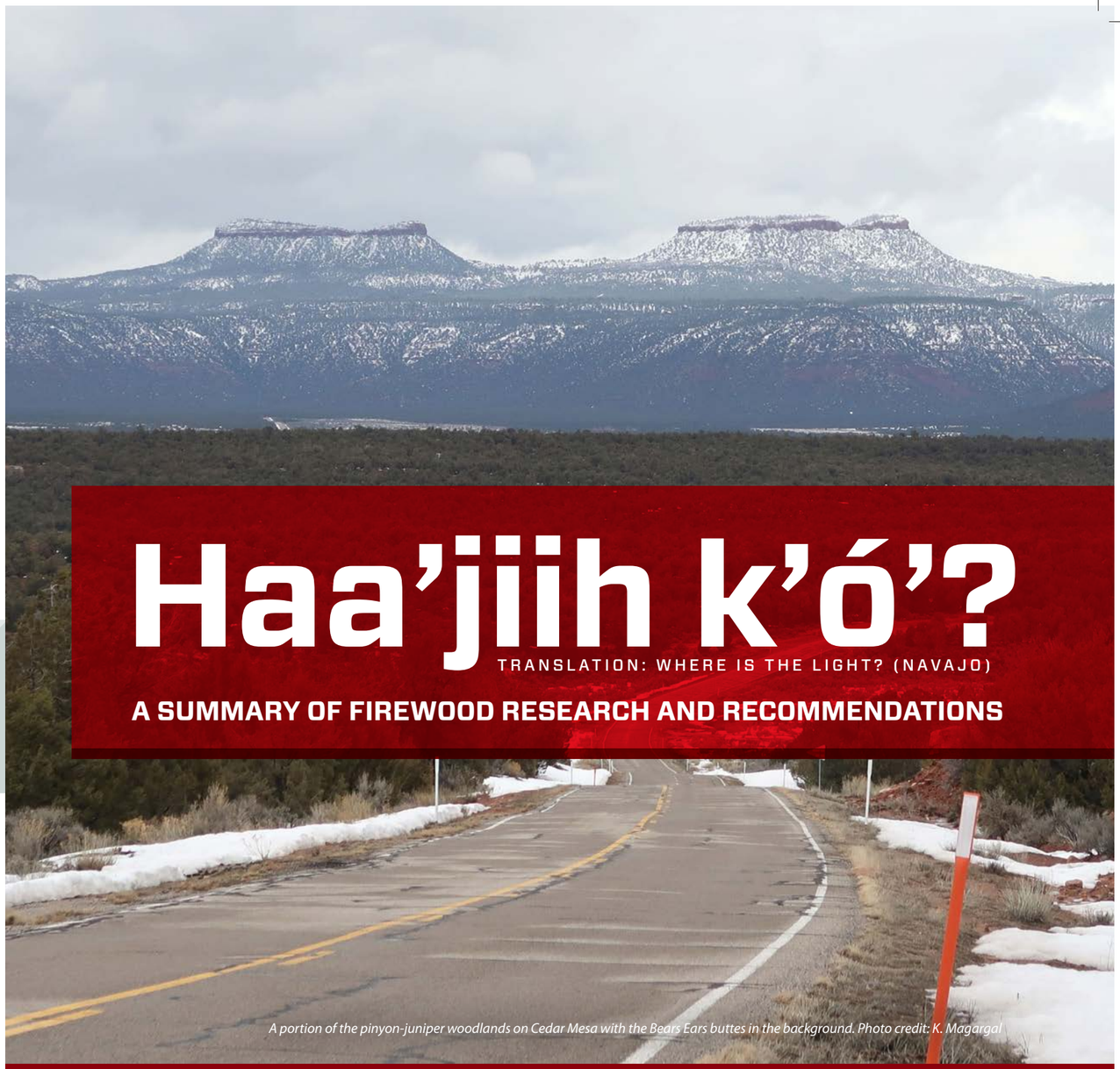
Policy Recommendations

1. Invite Native Woodhaulers into co-management structures
2. Re-establish Indigenous Forest Protector roles in Bears Ears National Monument
3. Increase availability of high efficiency, culturally appropriate home heating appliances
4. Increase capacity within Native communities to engage in forest management

More detail on this research and these policy recommendations can be found at: **https://firewood.anthro.utah.edu/**



Haa'jiih k'ó'?

TRANSLATION: WHERE IS THE LIGHT? (NAVAJO)

A SUMMARY OF FIREWOOD RESEARCH AND RECOMMENDATIONS

A portion of the pinyon-juniper woodlands on Cedar Mesa with the Bears Ears buttes in the background. Photo credit: K. Magargal

Summary of Research

Reliable access to firewood is critical for Indigenous communities living in the four-corners region of the United States. Firewood is central to the spiritual, cultural, and social needs of Navajo traditional life, and fulfills basic energy needs for a significant number of households. Between 80%–90% of Utah Diné rely on firewood collected from standing dead trees on federal and Tribal lands for home heating and cooking. Fuelwood which sustains Indigenous lives and livelihoods is under threat by two major factors: climate change and management policies. While local management decisions can do little to stop the impacts of global climate change on these woodlands, they can help reduce the impact of climate change on local communities. Here we review findings and policy implications from ongoing collaborative research examining these dynamics in the pinyon-juniper woodlands within and surrounding Bears Ears National Monument.

Citations

- Anderegg et al. (2020) *Science.* DOI: 10.1126/science.aaz7005.
- Anderegg et al. (2022) *Ecology Letters.* DOI: 10.1111/ele.14018.
- Campbell et al. (2021) *Remote Sensing of Environment.* DOI: 10.1016/j.rse.2021.112511.
- Magargal et al. (under review) *Human Ecology.*
- Magargal et al. (in prep. for 2023).

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Contributors (affiliations: 2018–2020 research role):

Authors

- Kate Magargal (U of U Anthropology, kate.magargal@utah.edu)
- Jonah Yellowman (Utah Diné Bikéyah)
- Gavin Noyes (Utah Diné Bikéyah, gavin@xmission.com)
- Brian Codding (U of U Anthropology, brian.codding@anthro.utah.edu)

Contributors

- Shaniah Chee (U of U Anthropology, and Dine College)
- Woody Lee (Utah Diné Bikéyah)
- Kevin Madalena (Utah Diné Bikéyah)
- William Anderegg (U of U Biology)
- Kelly Kerr (U of U Biology)
- Simon Brewer (U of U Geography)
- Philip Dennison (U of U Geography)
- Mickey Campbell (U of U Geography)
- Shane Macfarlan (U of U Anthropology)
- Courtenay Strong (U of U Atmospheric Science)
- Adam Kochanski (U of U Atmospheric Science)
- Molly Wabel (U of U Environmental & Sustainability Studies)

THE UNIVERSITY OF UTAH

UTAH DINÉ BIKÉYAH

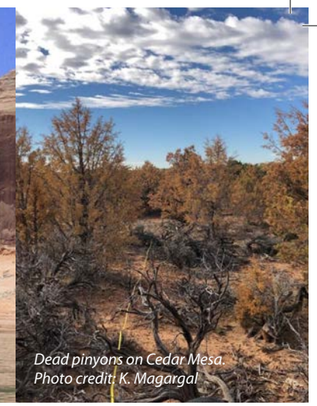
NSF

Willson Atene ignites a fire as part of preparing traditional Navajo food. Photo credit: Gavin Noyes

Tribal leaders in the four-corners region consistently identify firewood as a primary Traditional resource harvested from Cedar Mesa and other lands within and surrounding Bears Ears National Monument. As droughts continue to diminish the health of these woodlands, it will become critical for management planning to center Indigenous needs.

Climate change will impact the ability of local Native communities to meet their energy needs. This is most evident in the direct impact of droughts on woodland biomass. This process is already underway with acute drought causing massive tree mortality events locally *(Campbell et al. 2020)* and regionally *(Anderegg et al. 2020, 2022)*. Our projections suggest a 15% reduction in available biomass (on average across region) by the year 2100 *(Magargal et al. in prep. for 2023)*.

Lake Powell. Photo credit: NPS



Dead pinyons on Cedar Mesa. Photo credit: K. Magargal

Project timeline

2010
Utah Diné Bikéyah (UDB) began seeking to articulate firewood harvest research need, conducted interviews with 79 elders, and formed a "firewood team" with the Monticello Field office of BLM.

2013
UDB and the Navajo Nation publish findings from interviews with Tribal elders.

2015
UDB and University of Utah (UU) researchers begin collaborating through MOUs with BLM and USFS, resolutions from local chapter houses, and Internal Review Board approval from the Navajo Nation. Ute Mountain Ute Tribe declines formal involvement in the grant, although informal engagement continues.

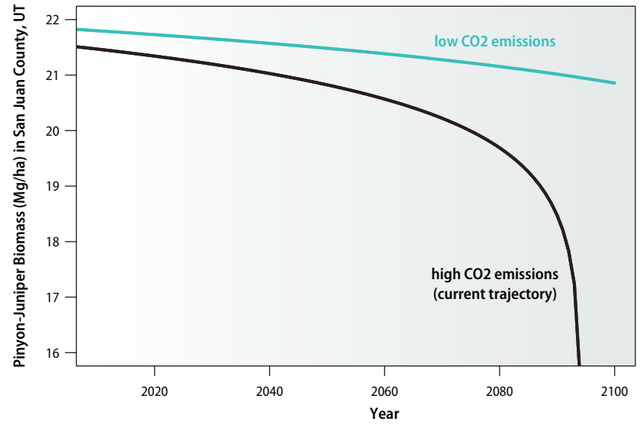
2017
UU and UDB are awarded NSF funds to conduct intensive research on firewood.

2018 & 2019
UU and UDB personnel conduct field research.

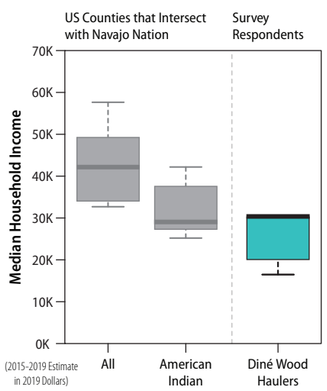
2020 to 2023
Researchers analyze results and create products to inform communities and planning processes.

Climate change will reduce firewood availability

Climate change will cause tree die-offs just as it causes lowered reservoir levels. Our modeling shows that biomass, or the total amount of plant material, in pinyon-juniper woodlands will decrease in the coming decades. The blue line shows what is likely under a low-emissions future if we drastically reduce global CO2 emissions. The black line shows what is likely under a high-emissions future if global CO2 emissions continue at current rates.

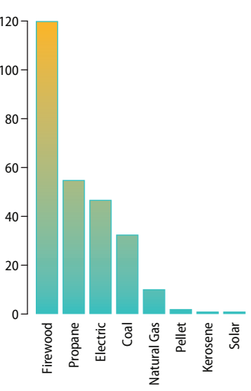


Wood Haulers have lower income than average community members



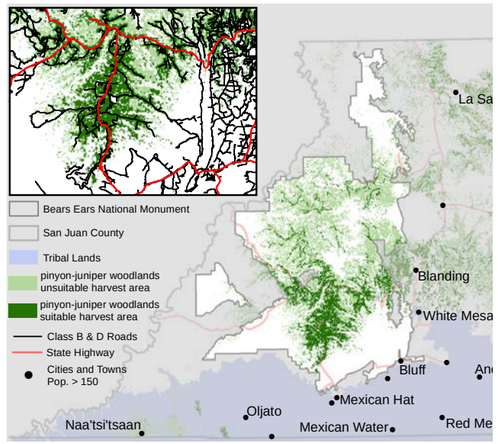
Boxes show median household income levels of households in counties intersecting Navajo Nation. Grey boxes are census data, the teal box is from this study. The median income of wood haulers rang is lowest of the three groups. See Magargal et al. *(under review at Human Ecology)*.

Firewood is the most common source of household energy



Various kinds of household energy are used across the Navajo Nation. Many households use multiple types of energy. See Magargal et al. *(under review at Human Ecology)*.

Suitable harvest locations are limited



Suitable harvest locations in pinyon-juniper woodlands are identified by a statistical model that selects all locations with similar characteristics to those chosen by Indigenous harvesters. To do this, the model uses information on wood density, travel time from communities, and distance from roads. Wood haulers seek out standing dead trees in areas of high wood density, low travel time, and proximity to roads. Details in Magargal et al. *(in prep. for 2023)*.

Mapping the decrease of available wood

Decreases in firewood availability will vary over time within Bears Ears National Monument. These four maps show the distribution of biomass in pinyon-juniper woodlands currently (left) and in the year 2100 (right). The bottom two maps show a zoomed in region called Cedar Mesa (a frequent location for wood harvesting). The two maps on the right show the projected distribution of biomass based on modeling of the high-emissions scenario in the year 2100 *(Magargal et al. in prep for 2023)*. Estimations of reductions in biomass are based on pinyon and juniper responses to drought stress *(Anderegg et. al 2022)* using a recent census of pinyon-juniper biomass modeled from satellite data *(Campbell et al. 2020)*. As trees die from climate-induced stressors, more firewood may become available in the short term. However, in the long term, fewer living trees will mean that some day harvest needs may surpass natural growth of local woodland biomass.