Part of NASA's Applied Sciences Program, DEVELOP conducts feasibility studies that bridge the gap between Earth science information and society. DEVELOP works with communities and organizations to address environmental and policy concerns through 10-week projects that help both participants and partners learn more about using geospatial information.

Interested? \bigcirc

Apply to participate at one of the DEVELOP locations. For more information on eligibility and a full list of locations, visit us online at https://appliedsciences.nasa.gov/ nasadevelop/apply.









Image of Wupatki Basin in north- western Arizona, derived from 2021 LANDSAT 8 imagery.

Sources

¹ Arizona Department of Water Resources. (2022). Drought. Retrieved on October 7, 2022 from https://new.azwater.gov/drought

²U.S. Forest Service. (2015). Drought and piñonjuniper woodlands: Changing fuel loads from tree mortality.

https://www.fs.usda.gov/rmrs/projects/drought-and-pi%C3%B1on-juniper-woodlands-changing-fuel-loads-tree-mortality

³ USFS. (2021, April 21). Drought causing juniper dieoff in central and northern Arizona. U.S. Forest Service. https://www.fs.usda.gov/detail/kaibab/newsevents/?cid=FSEPRD906836 ⁴ https://www.dontmovefirewood.org/

Image Credits

Mark Szydlo & Julie Long National Park Service



Have Questions?

Please contact us with any questions about the program at NASA-DL-DEVELOP@mail.nasa.gov.

www.nasa.gov NP-2023-01-007-LaRC National Aeronautics and Space Administration



Arizona Water Resources II

Utilizing Aerial Imagery and NASA Earth Observations to Assess Pinyon-Juniper Tree Mortality near Flagstaff, AZ

DEVEL

Where is Pinyon-Juniper woodlands (PJW) mortality in Wupatki Nat. Monument?

- In 2021, Wupatki National Monument's PJW experienced a 19.8% rate of mortality
- Mortality areas are shown in orange below



Here are the same trees 2 years apart.





2019 Trees

2021 Trees

How can you help?

- Learn about the roles Pinyon-Juniper trees play in an ecosystem
- Don't Move or Cut Firewood! This could potentially spread beetles or other invasive critters⁴





What's happening to the Pinyon-Juniper trees at Wupatki National Monument? They're dying. But why?

Researchers were **shocked**. These are some of the hardiest trees. We decided to investigate tree mortality through the NASA DEVELOP program.

Reasons for the tree mortality

The massive die-off is being traced back to Climate Change induced drought¹, which leaves the trees vulnerable to environmental stressors². We used data from Western Land Data Assimilation System (WLDAS) to discern that the primary stressors correlated to tree mortality were:



Less constant rainfall

Rising temperatures, more bare soil evaporation

Increase in wind speed

Why do we care?



- Ecological & hydrological shifts, altering
 - the local fire regime and fire risk³
- Threat to Southwestern culture Hopi,
 - Navajo, and Zuni Indigenous peoples³

Where is the area affected?

- 1.9-million-acres near Flagstaff, AZ
- Encompassing Wupatki National Monument and The Grand Canyon National Park
- PJW are depicted as green dots below



What is the extent of the tree mortality?

To calculate Juniper-Pinyon mortality, we created a classification model that worked by discerning living trees from dead trees.



Between 2015 – 2021, 21.63% of Pinyon-Juniper trees in the study area died.

