

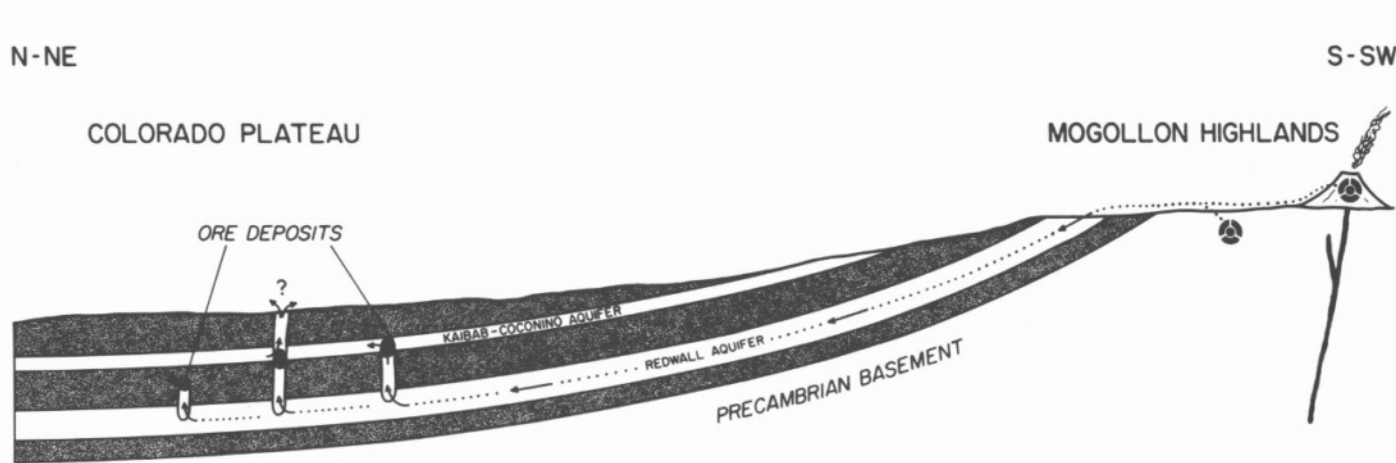


Uranium mining in Northern Arizona: Mineral rights, land use, and public policy

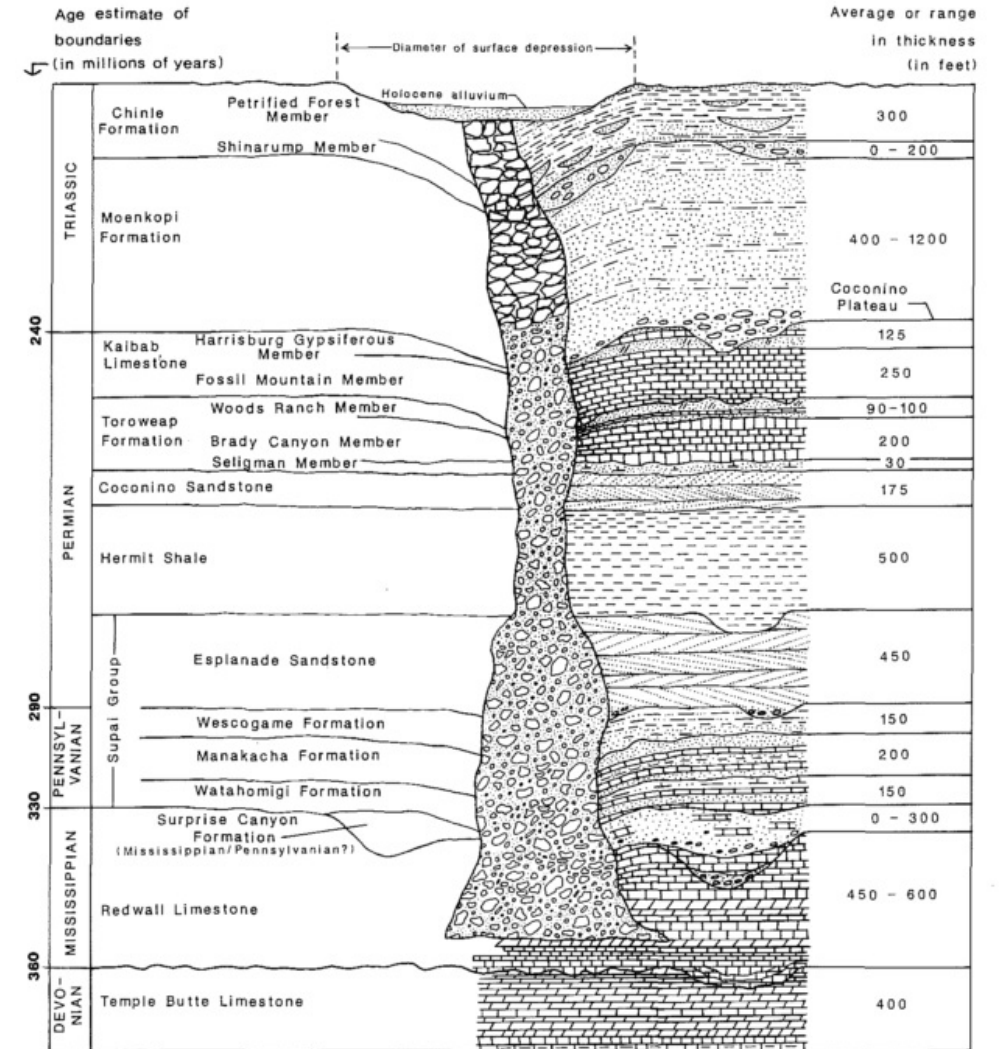
Emily Houlihan
January 31st, 2018

Uranium in the Grand Canyon

- Collapse breccia pipes caused by karst topography at depth
- Uranium transported by groundwater flow

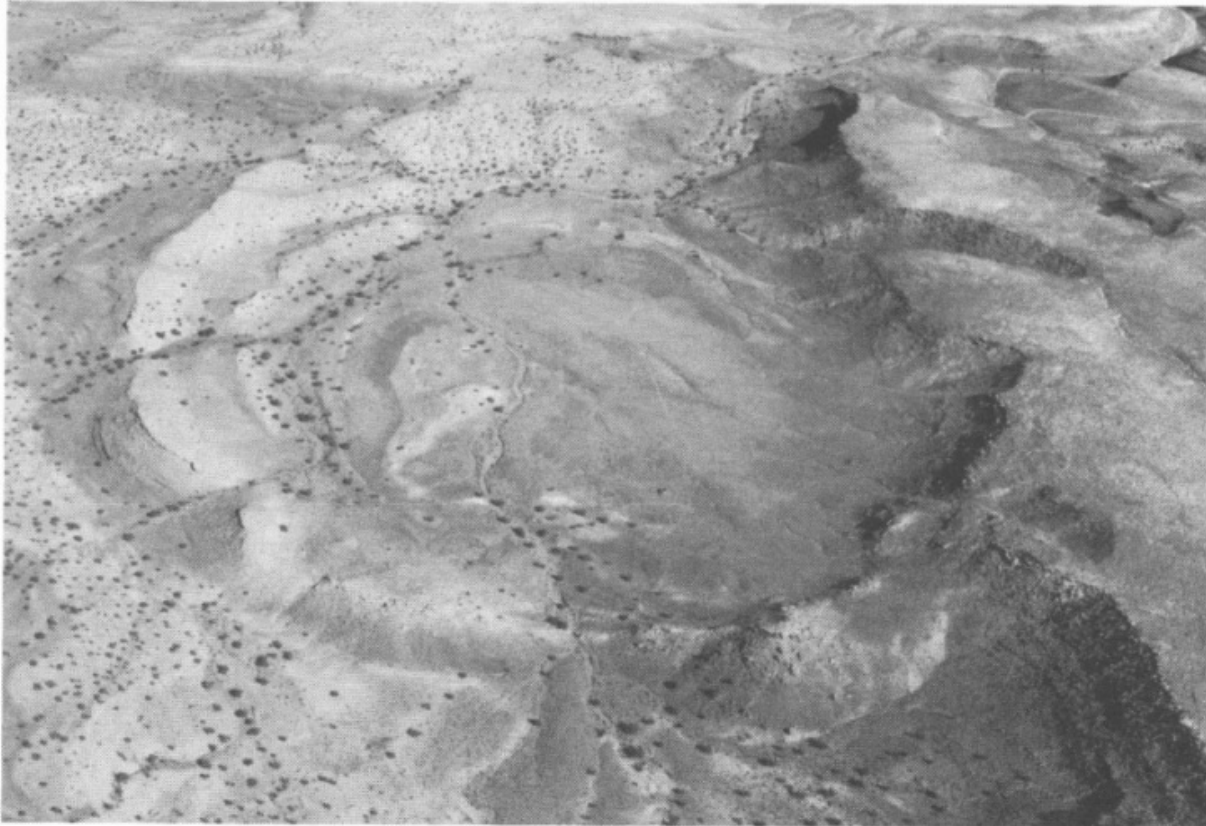


Wenrich and Huntoon (1989)



Wenrich (1985)

Uranium in the Grand Canyon



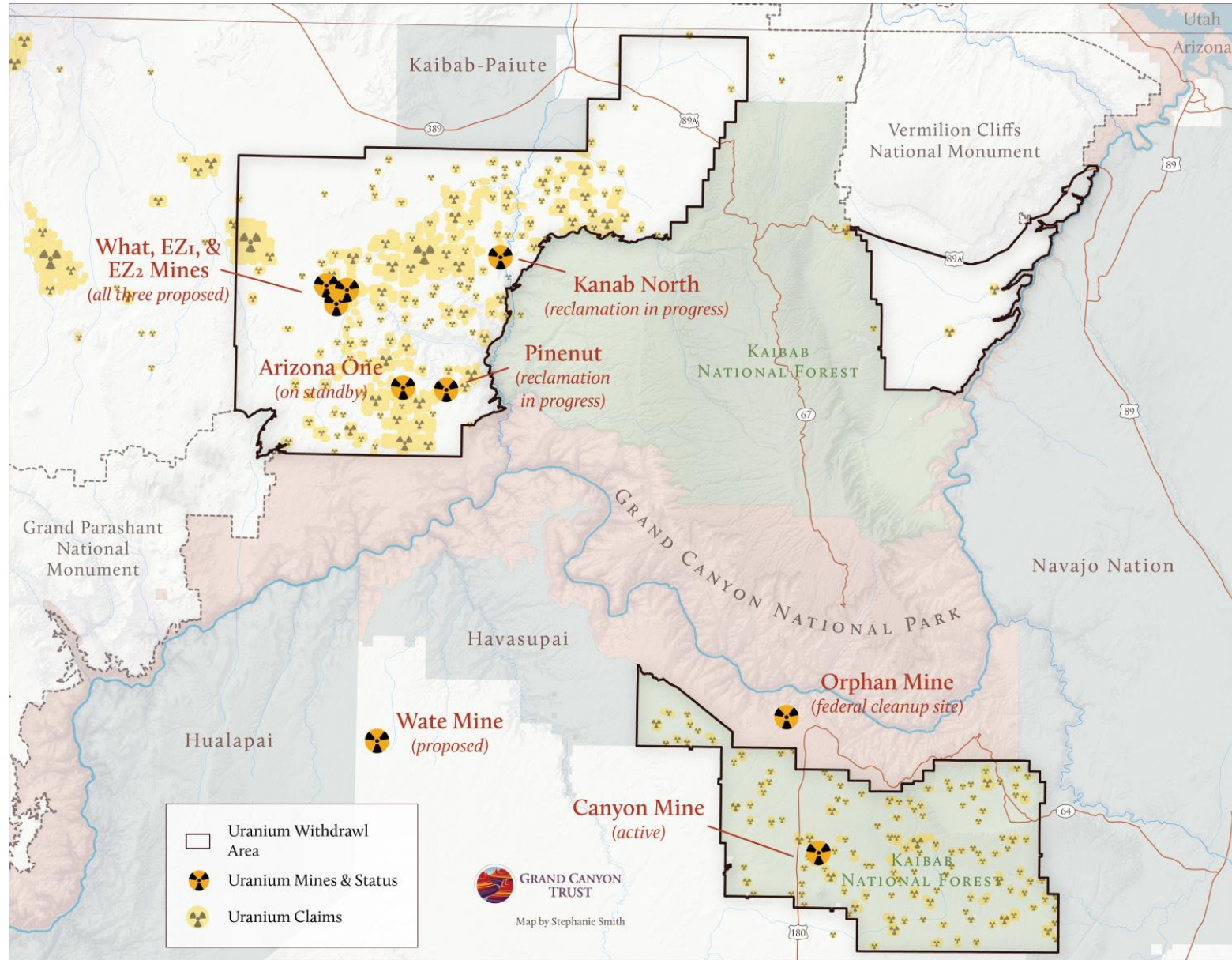
Collapse breccia pipes from top and side view.

Economic importance of uranium

~1.3 million tons of uranium ore in Northern Arizona (Finch et al., 1990)

US consumes 27,500 tons of uranium oxide yearly but only produces 1,750 to 2,250 tons.

Over 3,000 uranium claims in the withdrawn areas



Map from Grand Canyon Trust and USGS,
<https://www.grandcanyontrust.org/uranium>

Hazards and impact of uranium mining

Environmental hazards: **waste rock, dust,** and in situ **uranium ore disturbed by mining.**

Contaminants are dispersed by **floods, wind,** and **groundwater circulation.** The mines themselves are also radioactive and toxic to miners, tourists, and animals.

Health hazards: contaminated drinking water, exposure to toxins on site (abandoned mines), consuming tainted food (wildlife).



General Mining Act of 1872

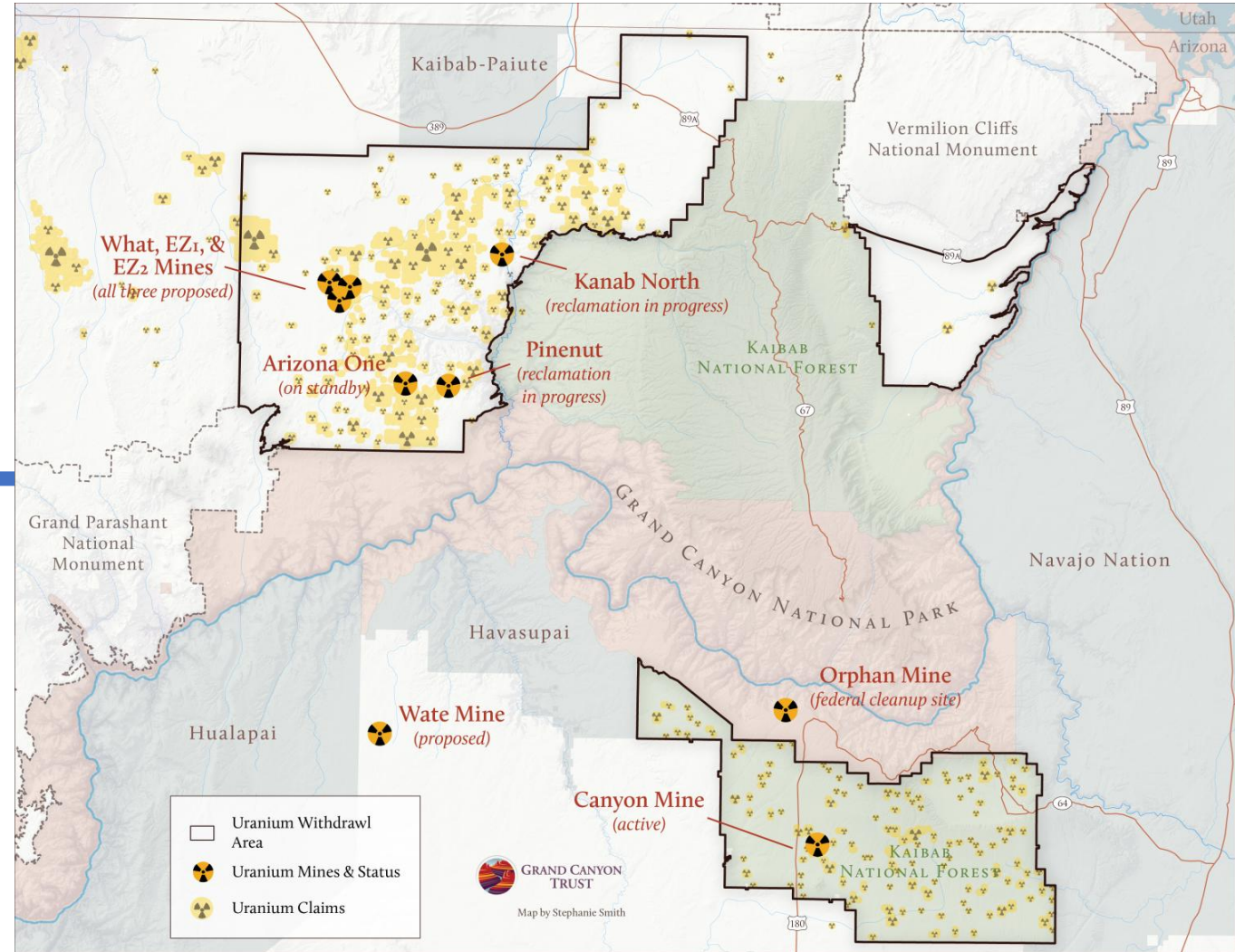
1872 General Mining Act: Opens federal land for mineral claims on platinum, gold, silver, copper, lead, zinc, uranium, and tungsten. Claims cost \$5 an acre or less. Once claims are staked and paid for, the government cannot interfere with mineral extraction.

- Act encourages development of public lands by allowing stakeholders to claim land for mineral rights cheaply and without subsequent constraint.
- Law has not changed since 1872, despite repeated attempts to amend.



Uranium mining and public policy – the modern

2008: House Natural Resources Committee blocks uranium mining claims near Grand Canyon



2009: Secretary of the Interior Ken Salazar issues two year moratorium on uranium mining claims in order to assess impact on environment (2010 USGS Special Investigation).

Uranium mining and public policy – the modern

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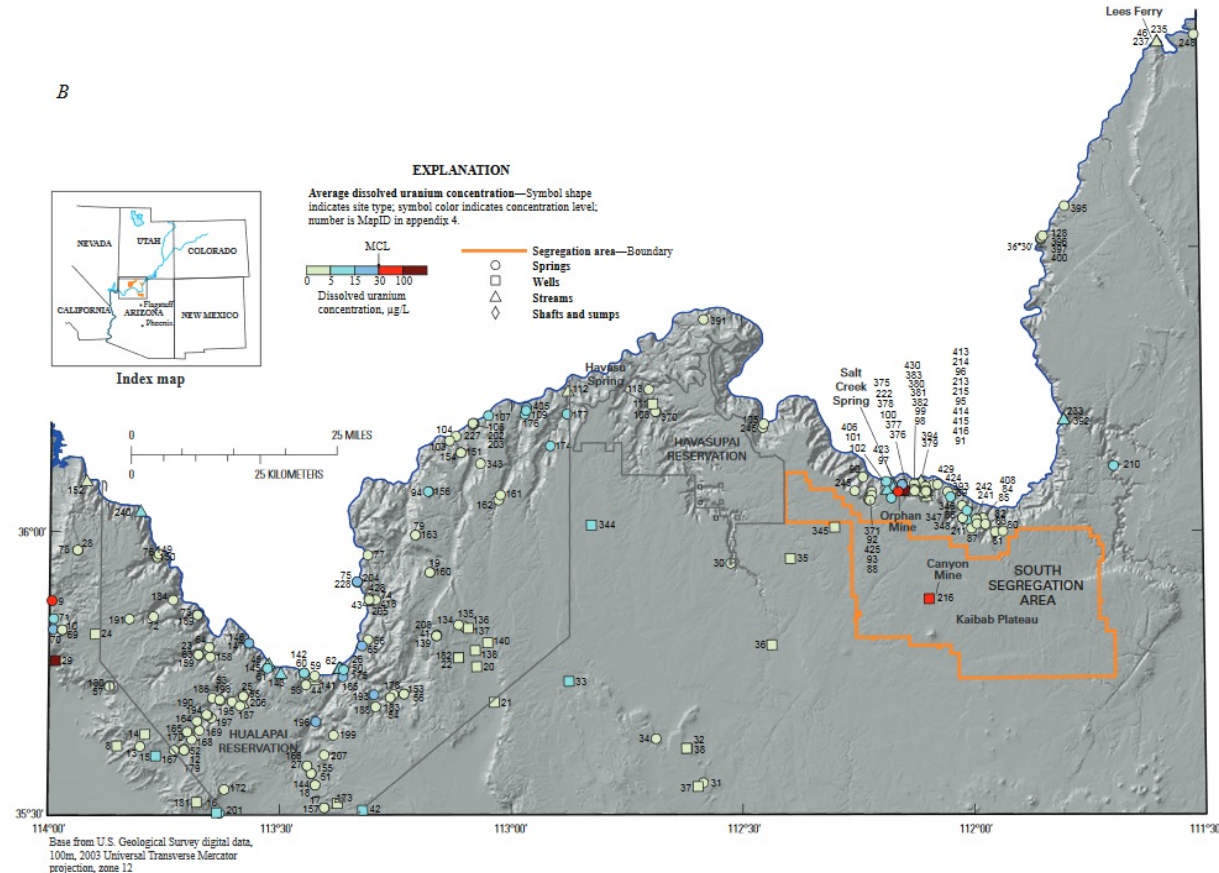
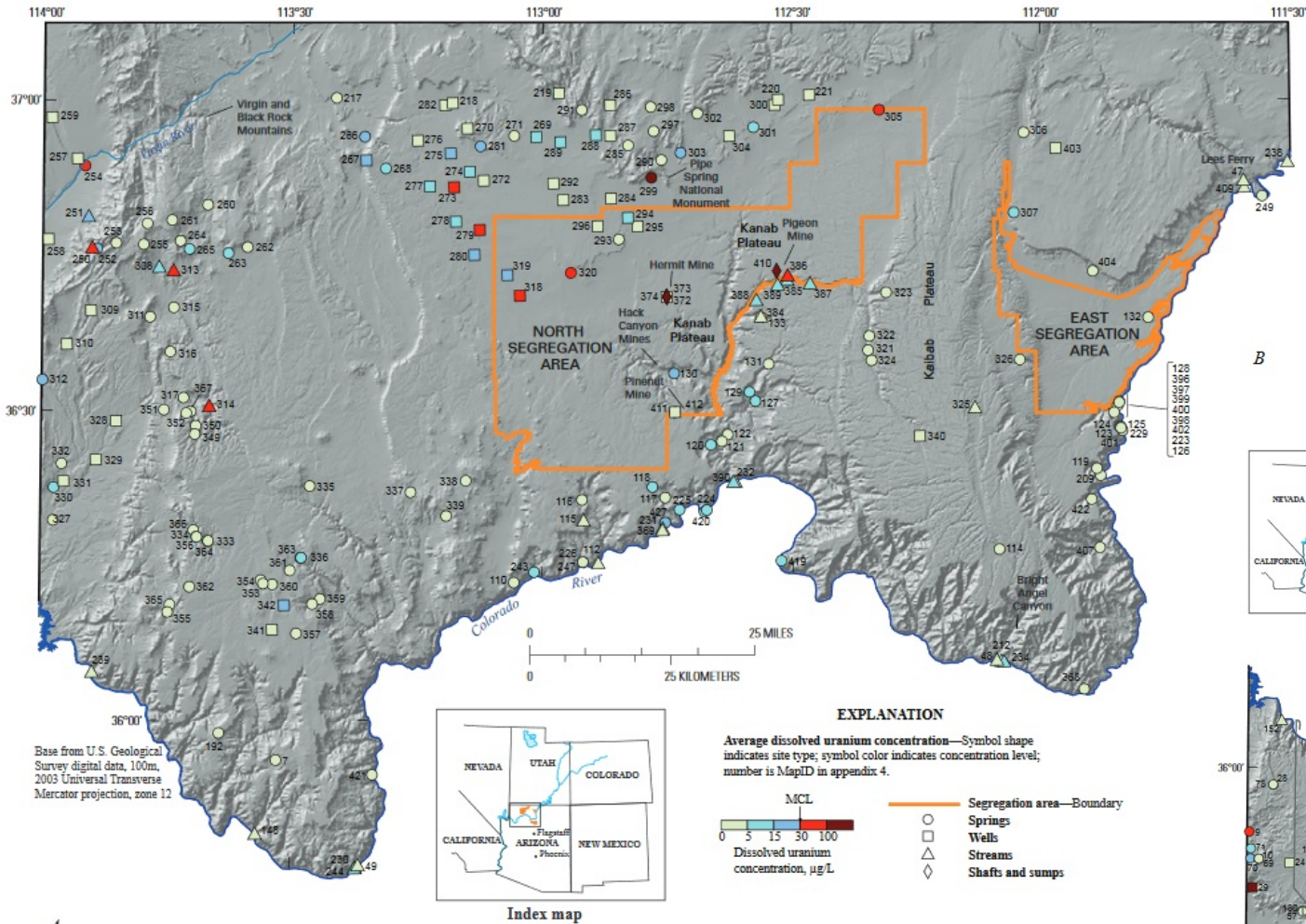
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Report focuses on:

- Availability of uranium in Northern Arizona breccia pipes
- Impact on wildlife (biologic pathways of contaminants)
- Impact on hydrologic systems (groundwater dispersal)
- Assess impact of mines already in existence

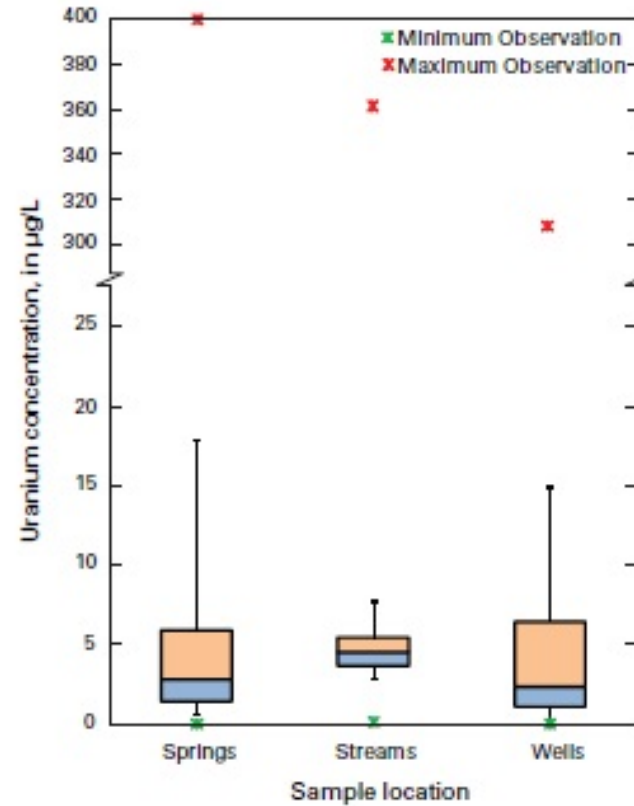
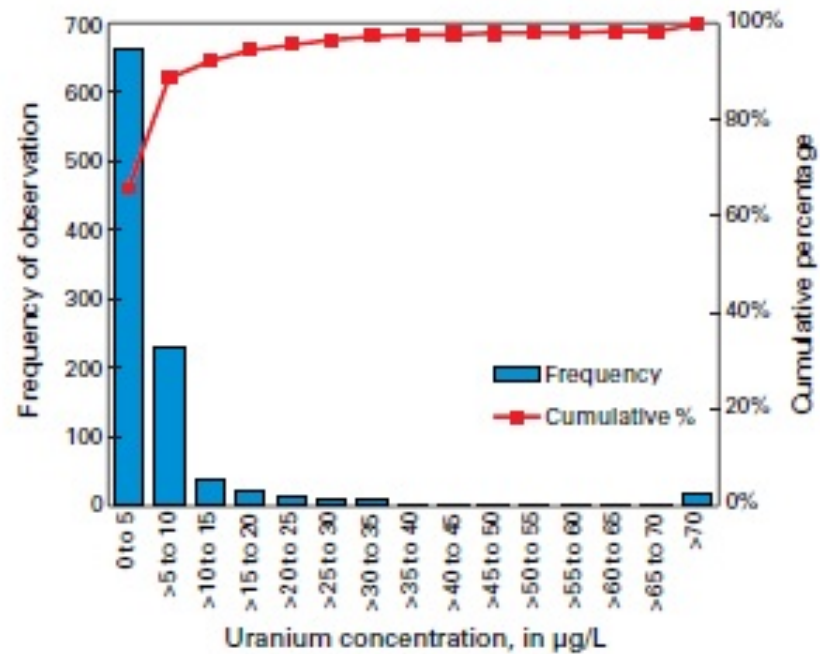
2010 USGS Special Investigation – water contamination

Contaminant	MLC
Uranium	30 µg/L
Arsenic	10 µg/L
Lead	15 µg/L
Mercury	2 µg/L
Molybdenum	40 µg/L



2010 USGS Special Investigation – water contamination

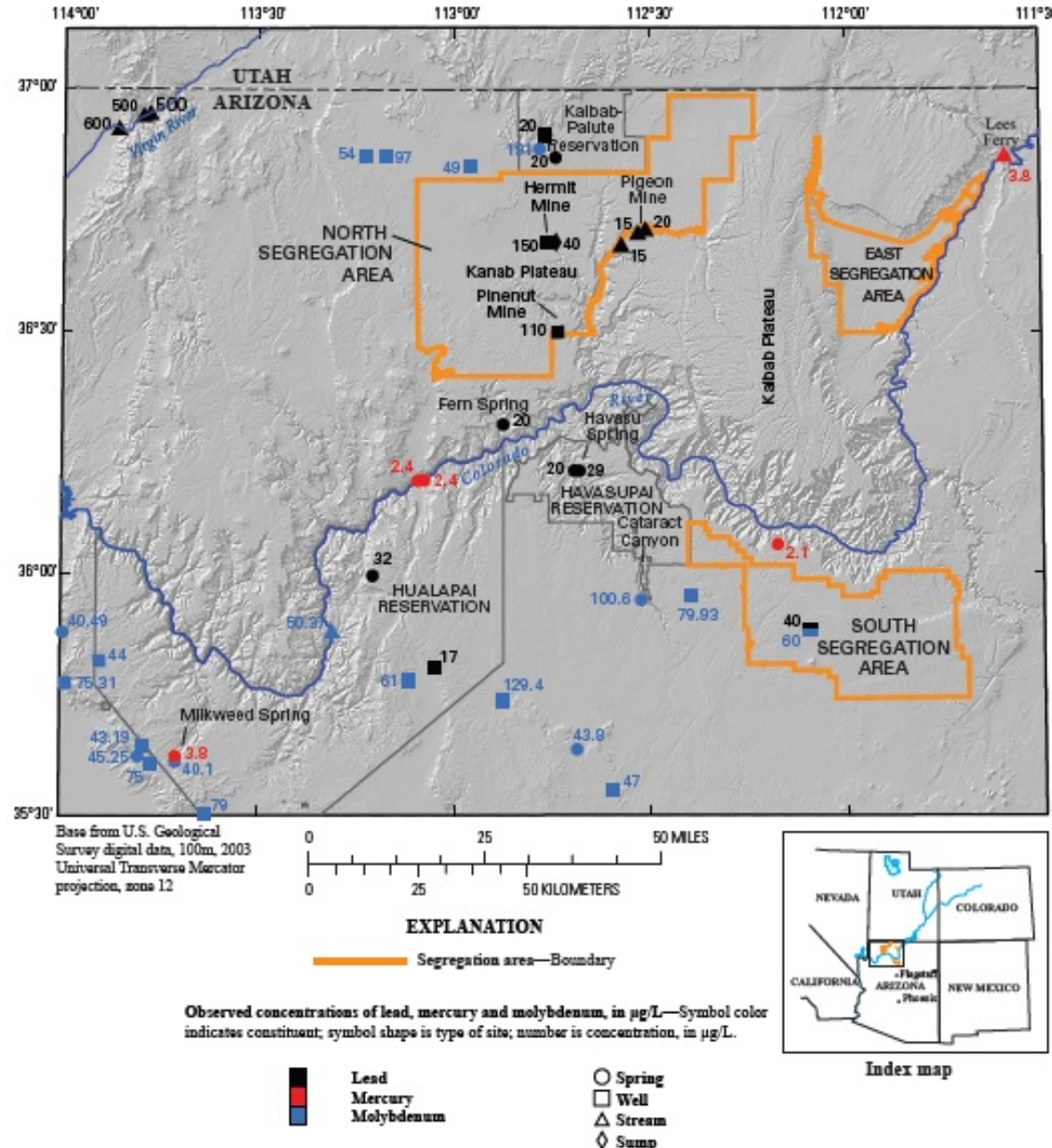
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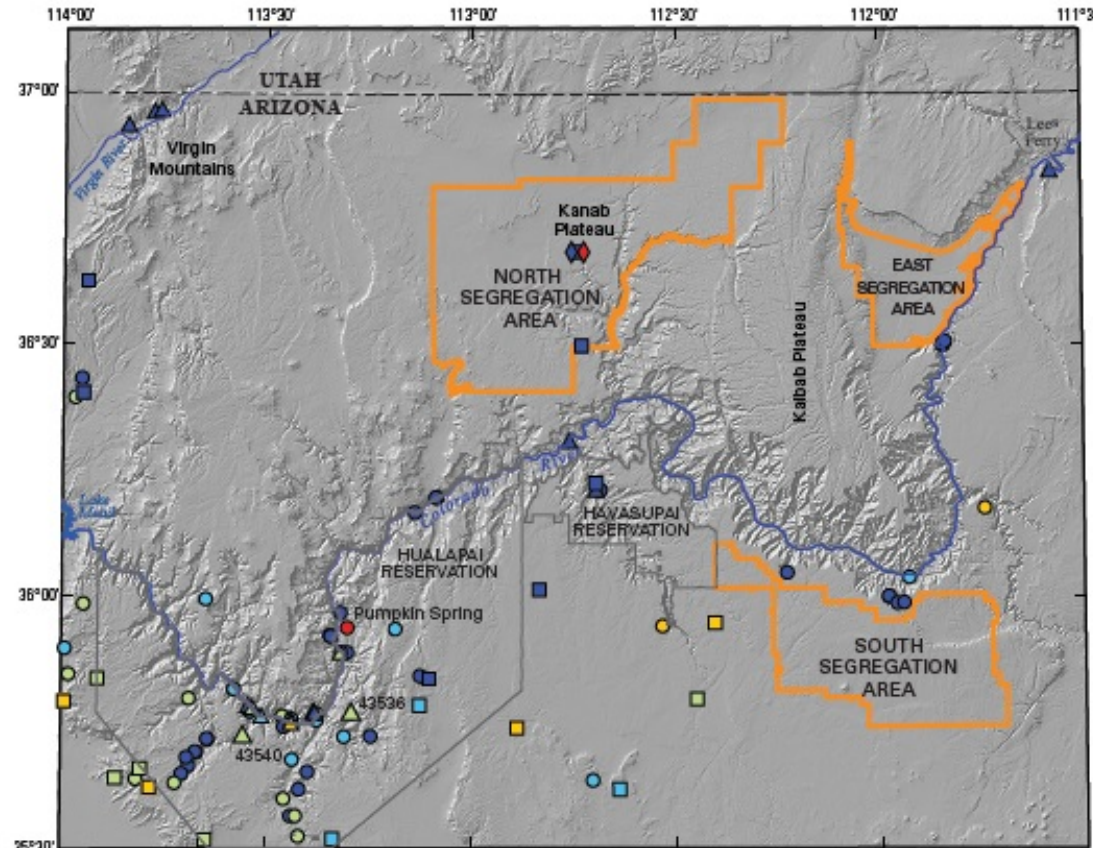
*Only water sources with levels above EPA MCL are shown. Over 400 water sources were tested in total.

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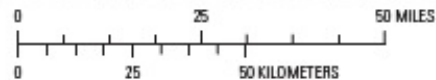


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Base from U.S. Geological Survey digital data, 100m, 2003 Universal Transverse Mercator projection, zone 12



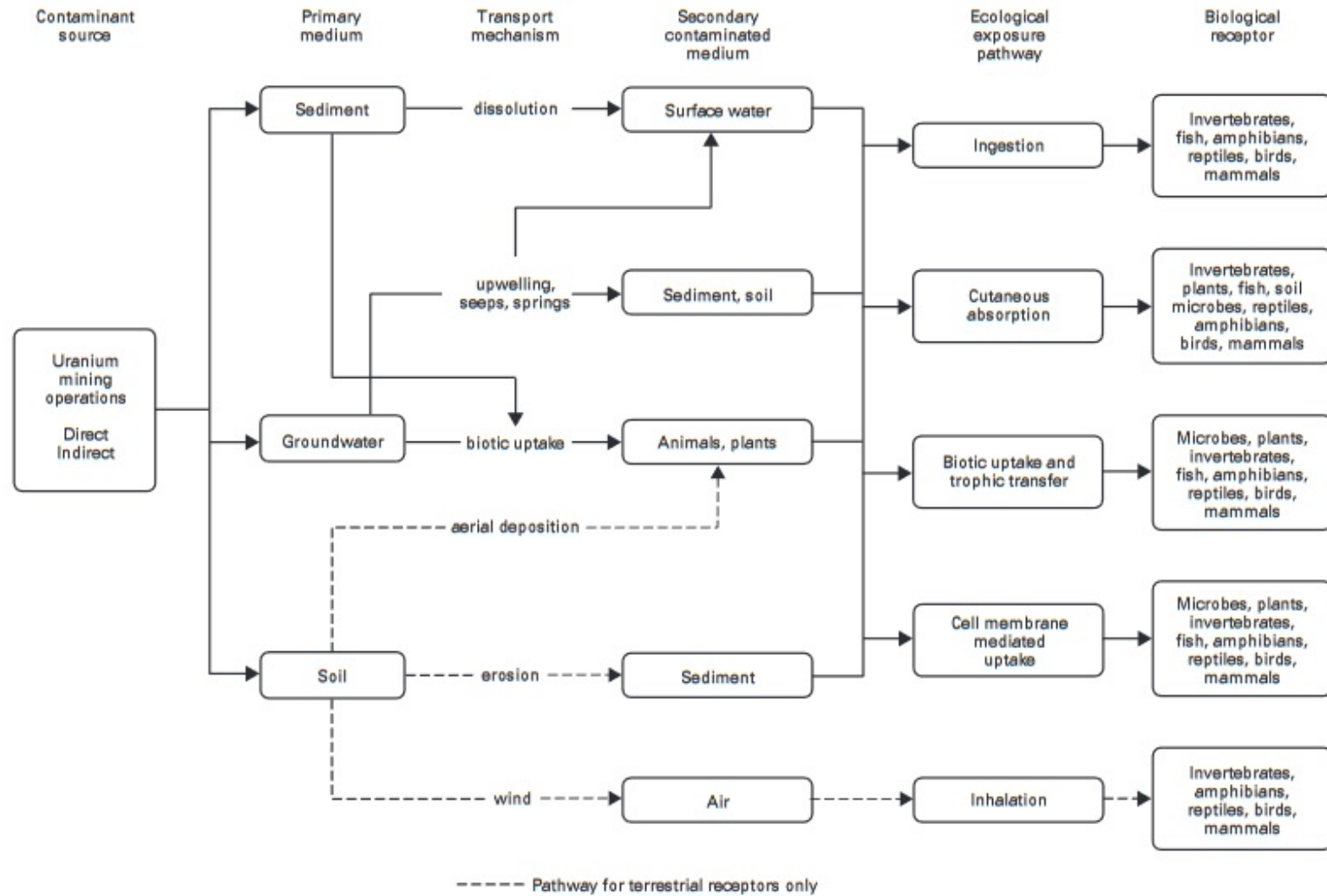
EXPLANATION

- Segregation area—Boundary
- Arsenic concentration, in $\mu\text{g/L}$ —Symbol shape is site type. Symbol color indicates concentration level.
- | | | |
|--|-------------|------------------|
| | 10 – 45 | ○ Spring |
| | 45 – 107 | □ Well |
| | 107 – 200 | △ Stream |
| | 200 – 350 | ◇ Sump and shaft |
| | 350 – 1,090 | |



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2010 USGS Special Investigation – biologic pathways



Biological Pathways of Exposure and Ecotoxicity Values for Uranium and Associated Radionuclides

By Jo Ellen Hinck, Greg Linder, Susan Finger, Edward Little, Donald Tillitt, and Wendy Kuhne

Chapter D of
Hydrological, Geological, and Biological Site Characterization of Breccia Pipe Uranium Deposits in Northern Arizona

Edited by Andrea E. Alpine

Uranium Resource Availability in Breccia Pipes in Northern Arizona

By James K. Otton and Bradley S. Van Gosen

Chapter A of
Hydrological, Geological, and Biological Site Characterization of Breccia Pipe Uranium Deposits in Northern Arizona

Edited by Andrea E. Alpine

Effects of 1980s Uranium Mining in the Kanab Creek Area of Northern Arizona

By James K. Otton, Tanya J. Gallegos, Bradley S. Van Gosen, Raymond H. Johnson, Robert A. Zielinski, Susan M. Hall, L. Rick Arnold, and Douglas B. Yager

Chapter B of
Hydrological, Geological, and Biological Site Characterization of Breccia Pipe Uranium Deposits in Northern Arizona

Edited by Andrea E. Alpine

Historical and 2009 Water Chemistry of Wells, Perennial and Intermittent Streams, and Springs in Northern Arizona

By Donald J. Bills, Fred D Tillman, David W. Anning, Ronald C. Antweiler, and Thomas F. Kraemer

Chapter C of
Hydrological, Geological, and Biological Site Characterization of Breccia Pipe Uranium Deposits in Northern Arizona

Edited by Andrea E. Alpine

Scientific Investigations Report 2010–5025

U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Report 2010–5025

U.S. Department of the Interior
U.S. Geological Survey

Conclusion: More monitoring is needed to determine the true effects of mining on biology, groundwater resources, and communities in Northern Arizona.

Uranium mining and public policy – the modern

2008: House Natural Resources Committee blocks uranium mining claims near Grand Canyon

2010: USGS conducts preliminary investigation into environmental impacts of uranium mining



2017: Trump Administration begins steps to reopen uranium mines near Grand Canyon.

Court upholds uranium mining ban around Grand Canyon but allows nearby mine

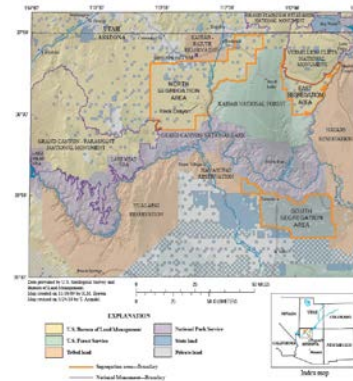


Visitors to Mather Point at Grand Canyon National Park look out over a rare total cloud inversion in 2013. (National Park Service, Eric Whitman/WP)

The U.S. Court of Appeals for the 9th Circuit on Tuesday upheld a 20-year ban on uranium mining around Grand Canyon National Park but ruled in a separate case that a uranium company could open a mine nearby.

The two unanimous rulings by the three-judge panel came as the Trump administration considers lifting the ban. It also comes near a broader effort to boost domestic energy production and promote the

2009: Secretary of the Interior Ken Salazar issues two year moratorium on uranium mining claims in order to assess impact on environment (2010 USGS Special Investigation).



2012: Ken Salazar issues uranium mining withdrawal for 1.7 million acres near the Grand Canyon blocking any new uranium claims for 20 years, citing environmental effects.

2018: uranium mining continues near the Grand Canyon, and the long-term impact remains unknown.

Questions?

