Rapid spontaneous restoration of Glen Canyon ecosystems as Lake Powell dries

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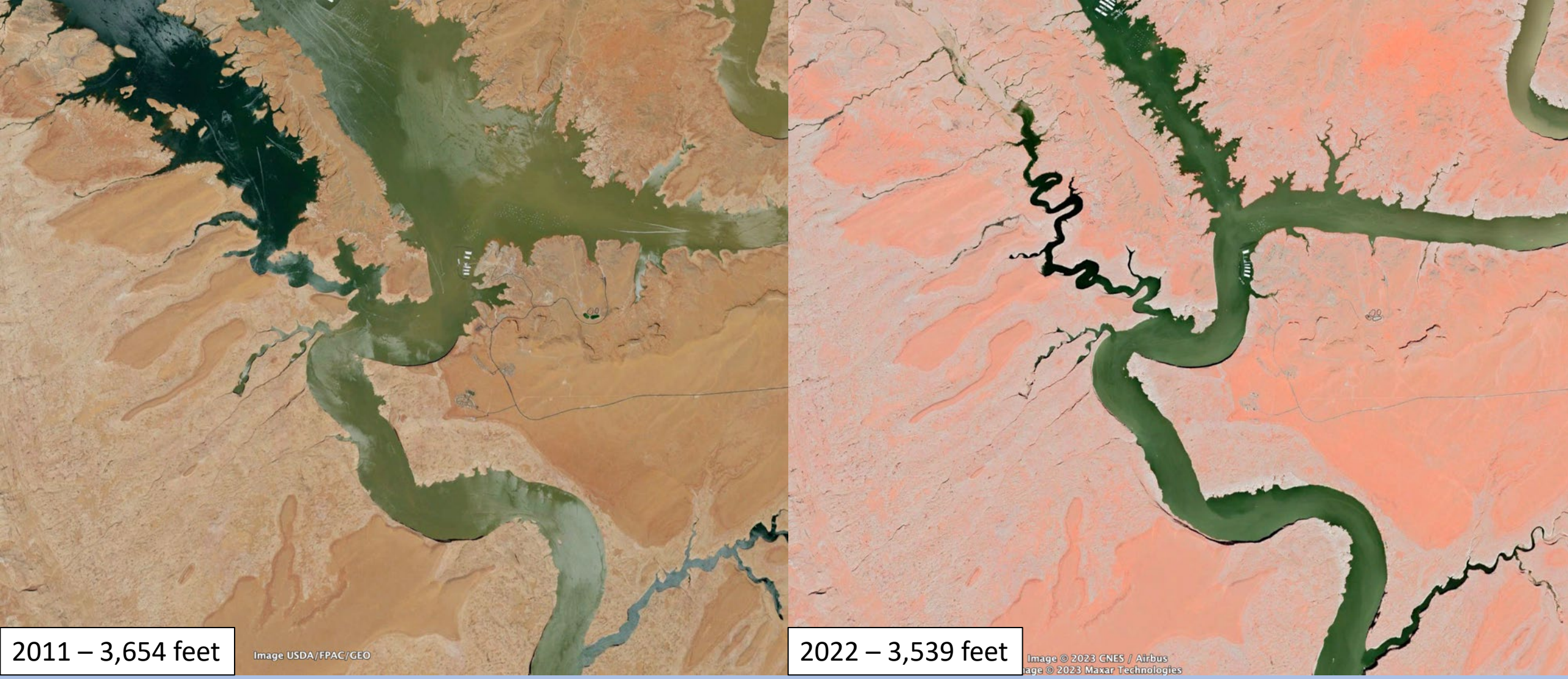
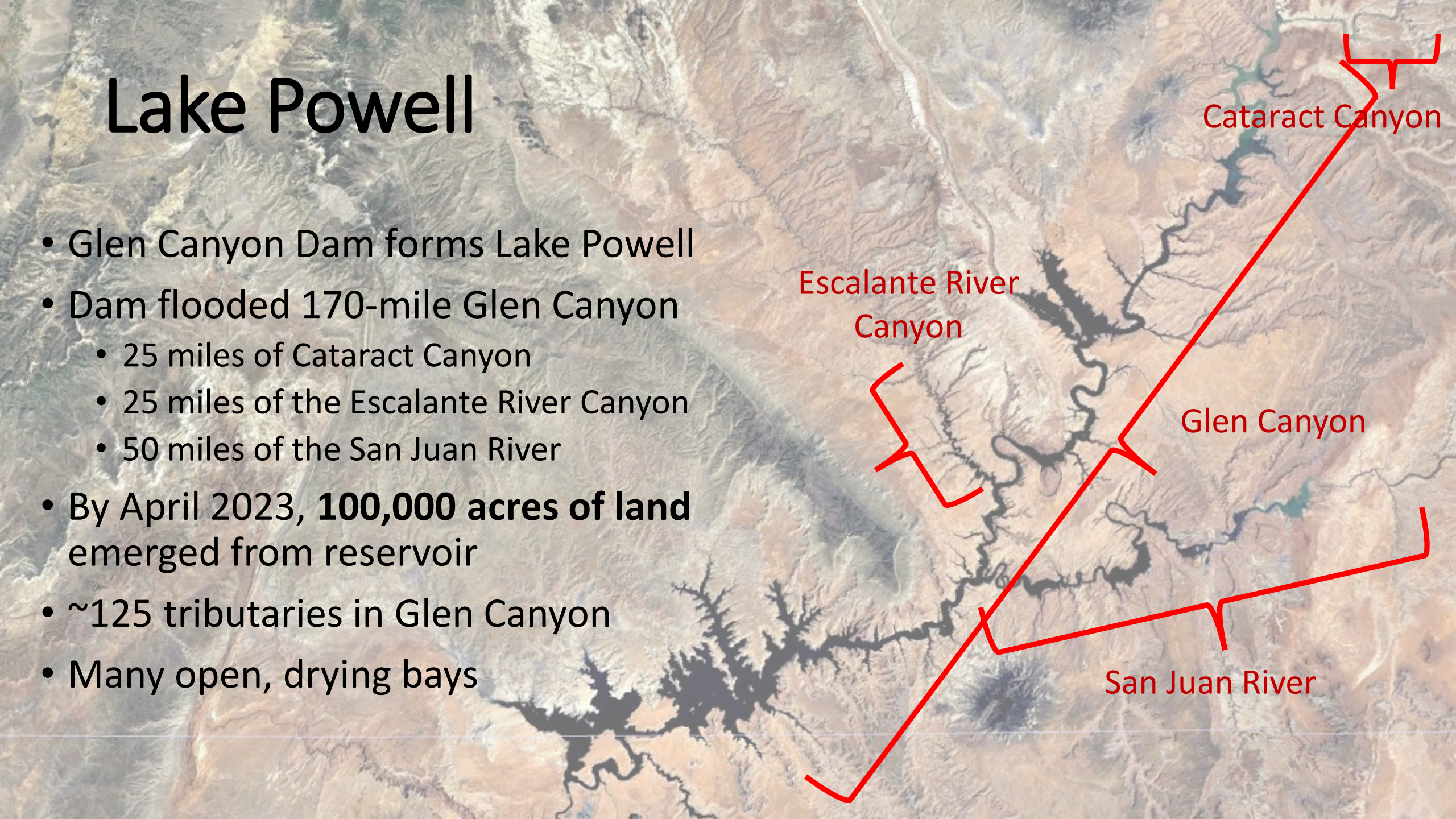
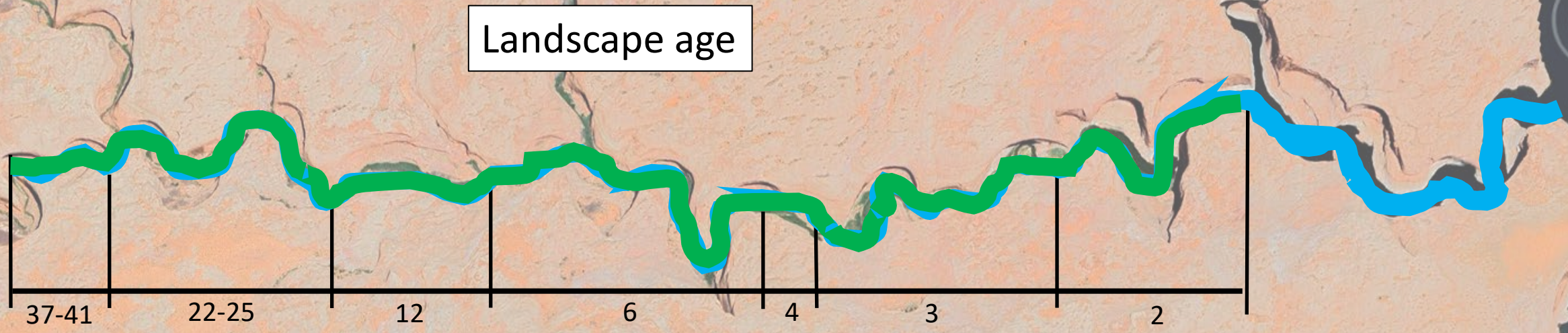


- Drying Lake Powell – dropped 180 feet in last 25 years
- Caused by water use, drought, climate change
- **Over 100,000 acres of land emerged in Glen Canyon**

Lake Powell

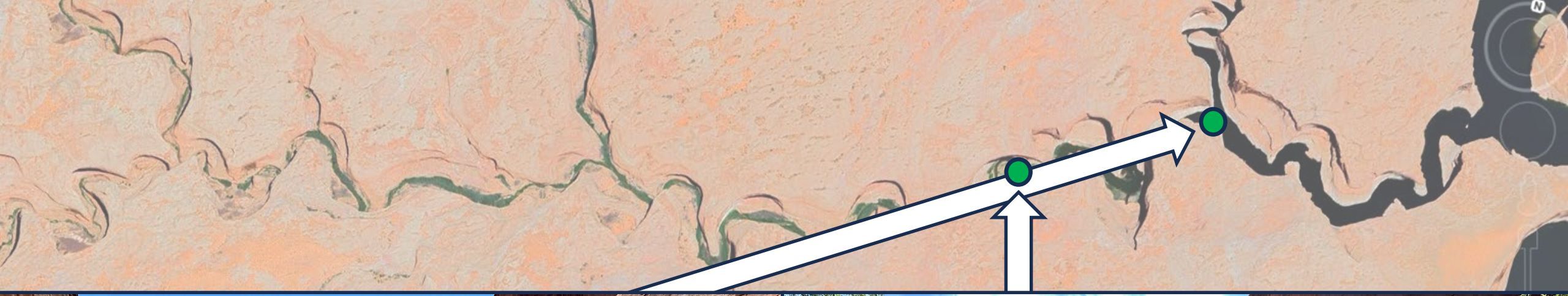
- Glen Canyon Dam forms Lake Powell
- Dam flooded 170-mile Glen Canyon
  - 25 miles of Cataract Canyon
  - 25 miles of the Escalante River Canyon
  - 50 miles of the San Juan River
- By April 2023, **100,000 acres of land** emerged from reservoir
- ~125 tributaries in Glen Canyon
- Many open, drying bays

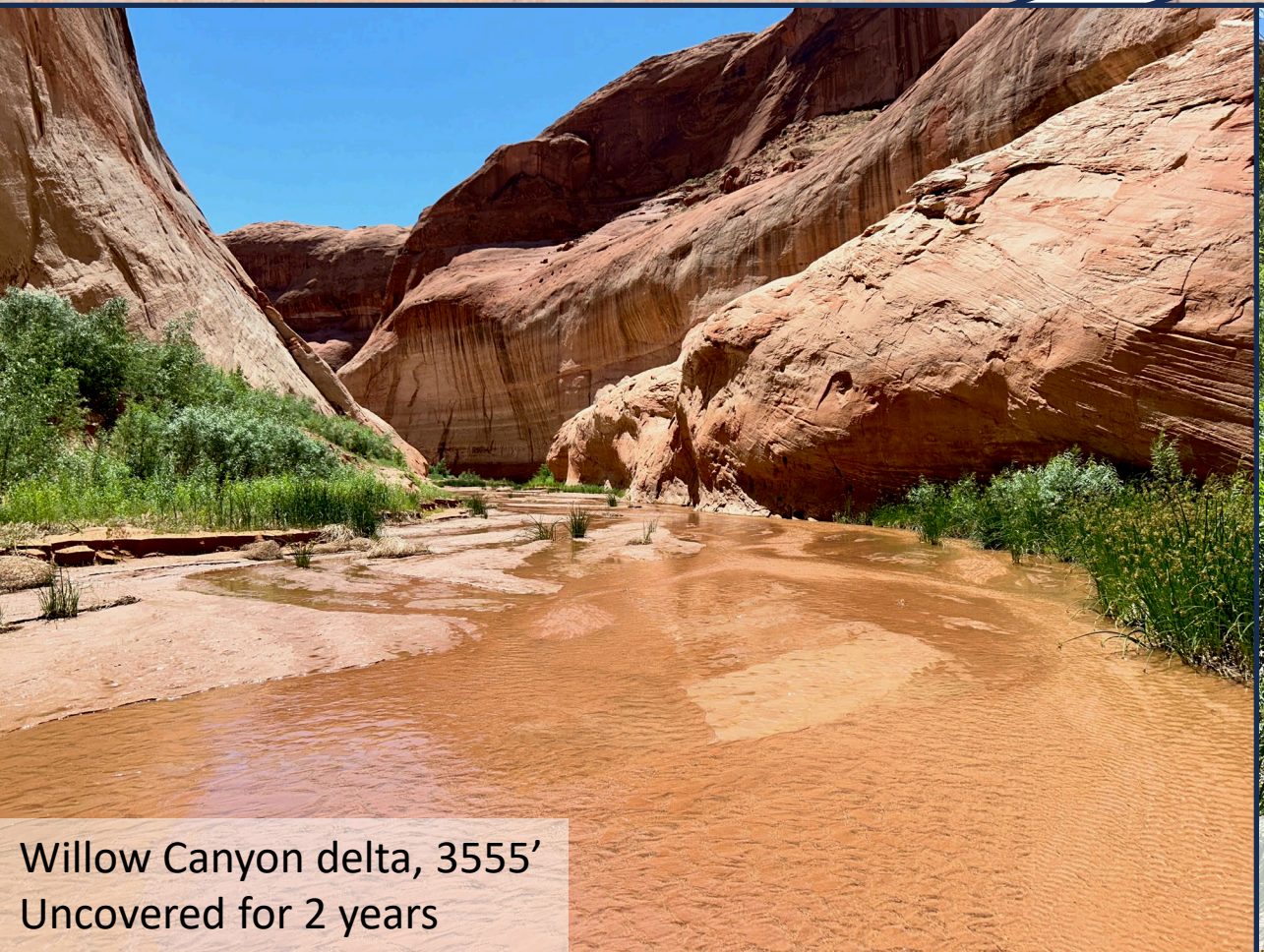




Willow Canyon – A photographic tour

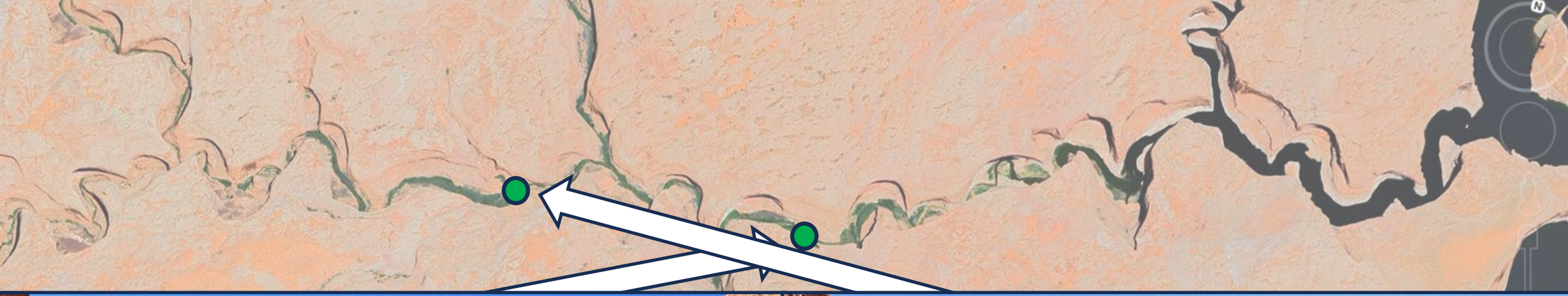
- Long, low gradient, spring-fed canyon; perennial water
- At full pool, Lake Powell extended 5 miles up canyon
- In May 2023, Powell extended 1 mile up canyon
  - 4 miles of canyon exposed since 1999
- Walking up Willow Canyon like walk back in successional time
  - Landscape age related to elevation





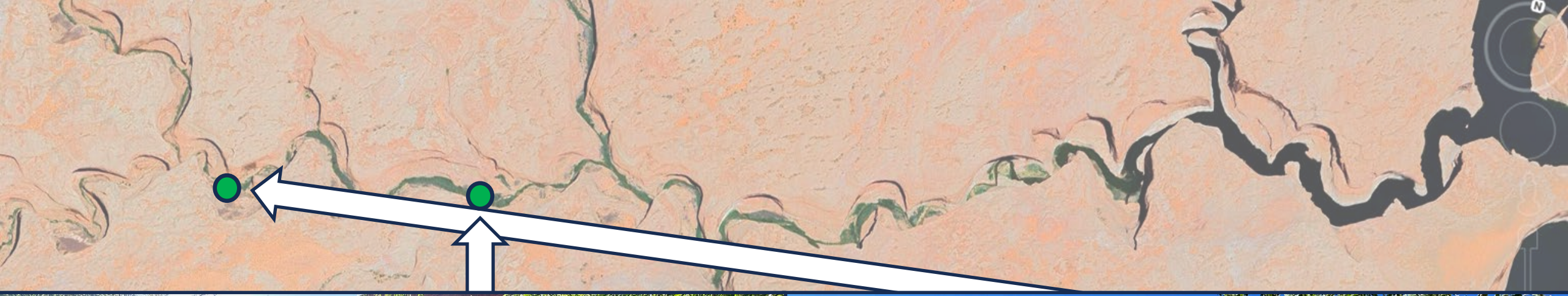
Willow Canyon delta, 3555’
Uncovered for 2 years

Willow Canyon, 3600’
Uncovered for **3-4 years**



Willow Canyon, 3615’
Uncovered for **4 or 6 years**

Willow Canyon, 3630’
Uncovered for **6 or 12 years**



Willow Canyon, 3645’
Uncovered for **12 years**

Willow Canyon, 3680’
Uncovered for **24 years**

Restoring hanging garden, 3610’
Reflection Canyon
Uncovered for **3 or 5 years**

Restoring hanging garden, 3625’
Cottonwood Gulch
Uncovered for **5 or 11 years**

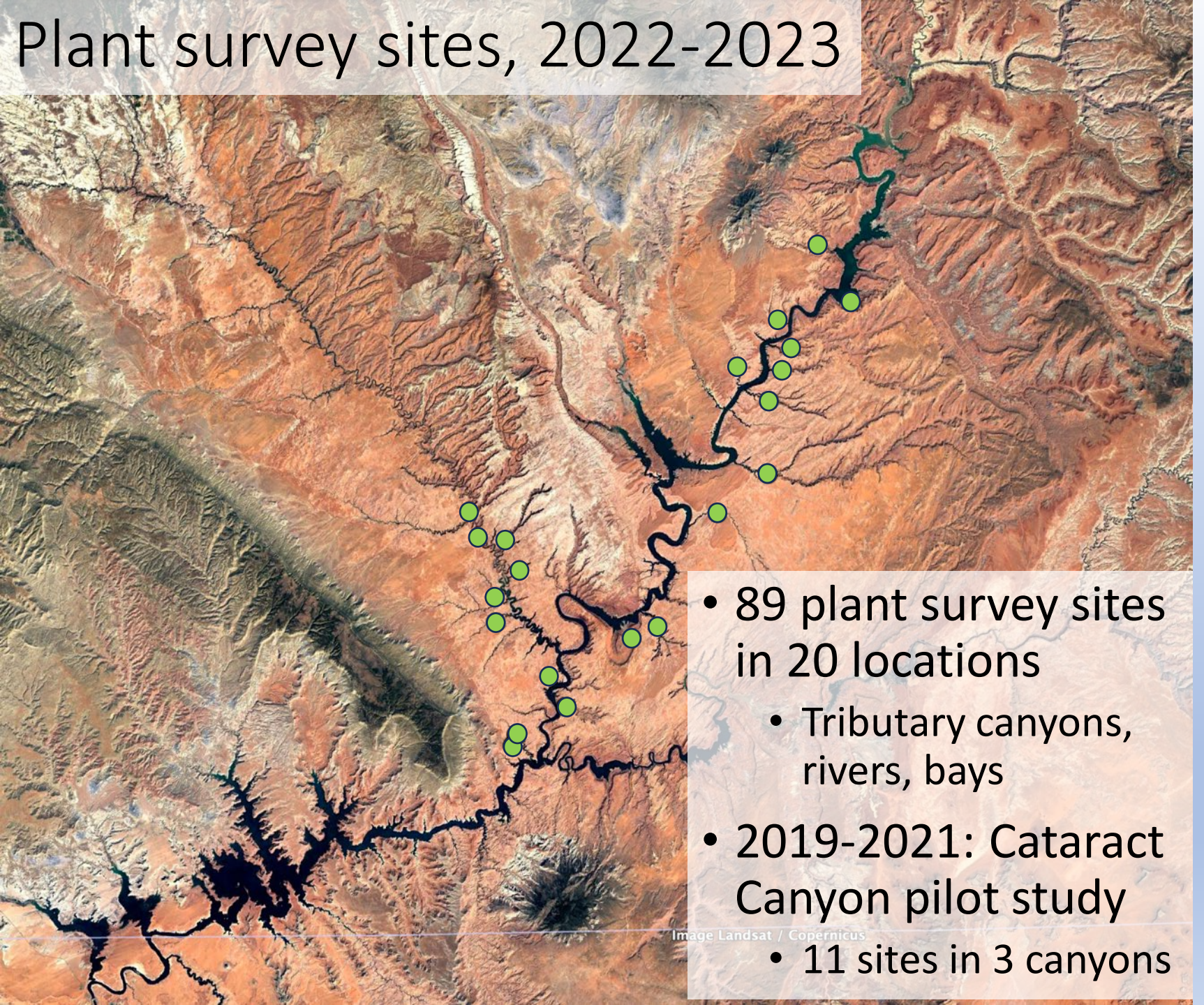
Restoring hanging garden, 3680’
Wall Spring, Ticaboo Canyon
Uncovered for 22-39 years

Restoring hanging garden, 3690’
Peshliki Canyon
Uncovered for 23-39 years

Restoring cryptobiotic crust
Willow Canyon, 3660’
Uncovered 22 years

Restoring cryptobiotic crust
Cow Canyon, 3690’
Uncovered 24 years

Plant survey sites, 2022-2023



- 89 plant survey sites in 20 locations
  - Tributary canyons, rivers, bays
- 2019-2021: Cataract Canyon pilot study
  - 11 sites in 3 canyons

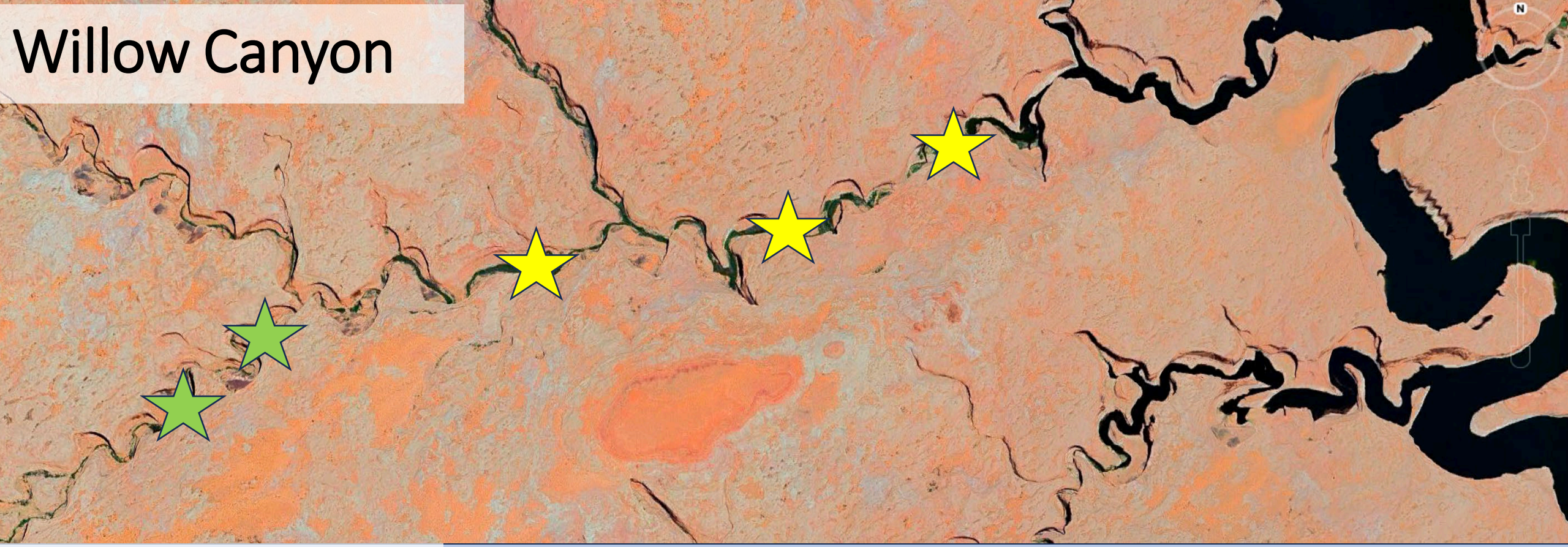
4 year study

What plants/ecosystems are establishing on emerging landscapes?

How do ecosystems change over time?

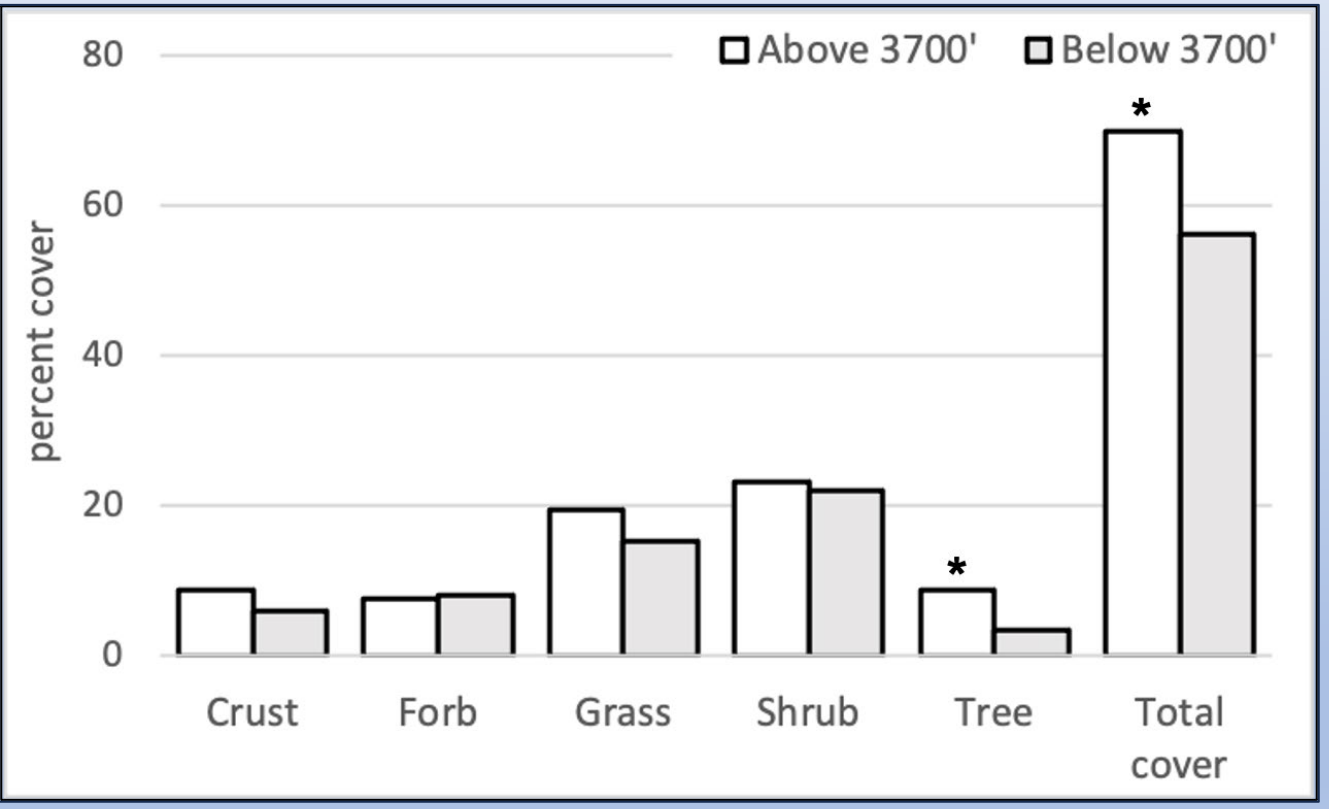
Years 1-2: establish sites
Years 3-4: re-survey sites

Willow Canyon



- Two above 3700’
- Three below 3700’
  - Target 3 elevations
  - 3675’ – 22 years
  - 3625’ – 5 years
  - 3575’ – 1-2 years

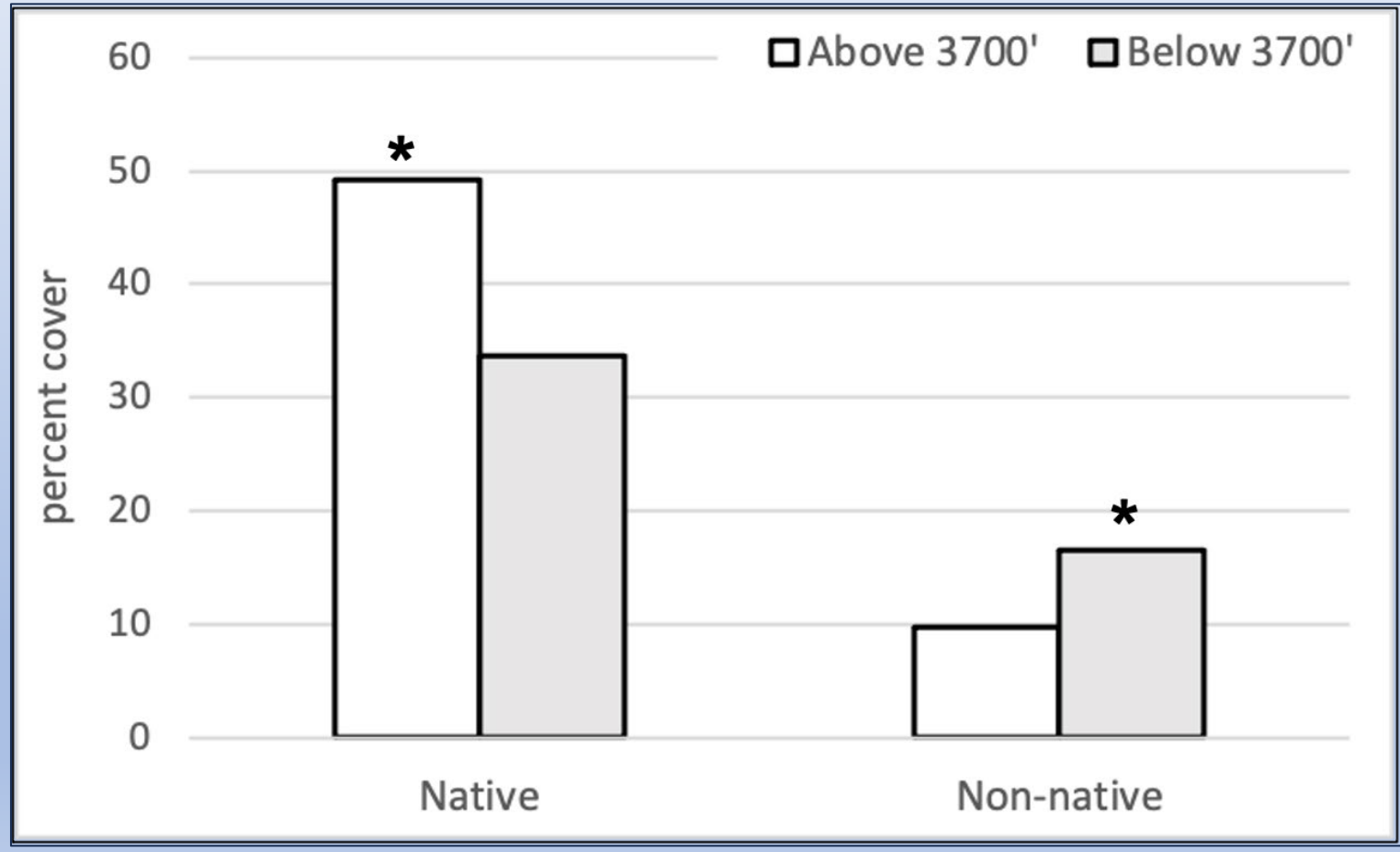
What types of plants are growing?



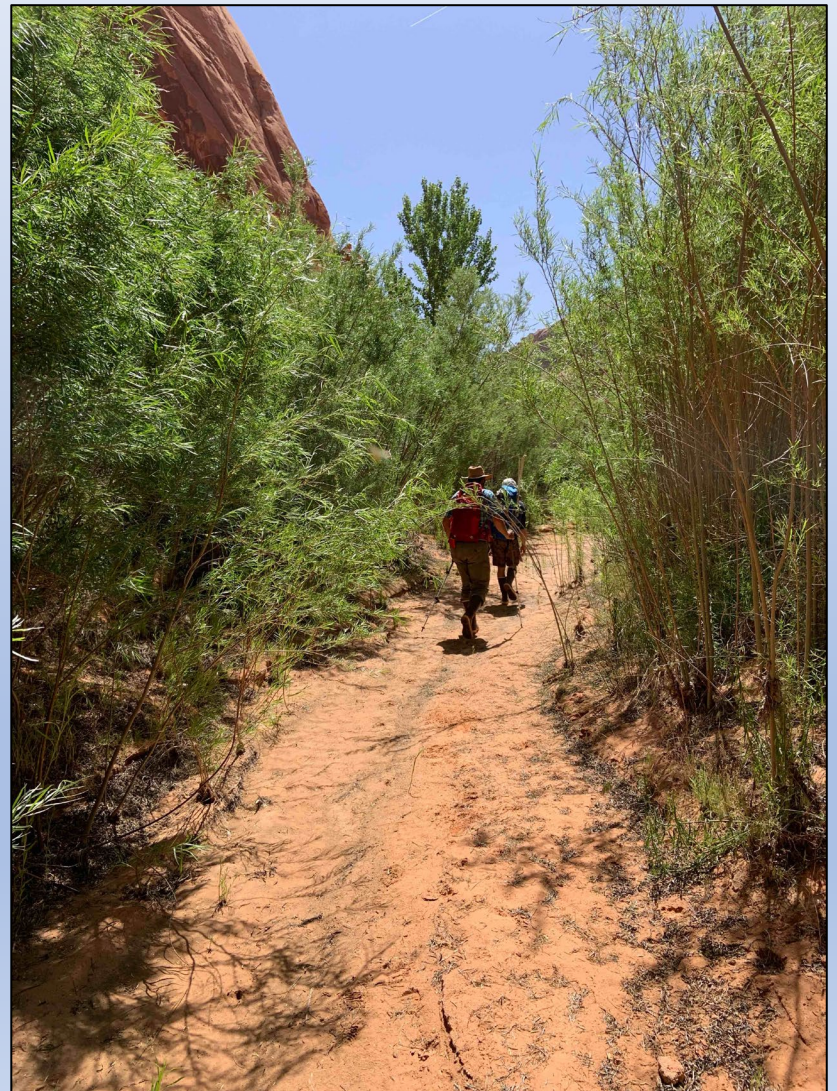
- Greater **total cover** and **tree cover** at sites above 3700’
- Similar cover of forbs, grasses and shrubs
- More crust above 3700’
  - Crust well-established at many sites exposed for >12 years

Native v. non-native plants

- Greater cover of native plants above 3700’
- Greater cover of non-native plant below 3700’
- Most abundant non-native species:
  - Tamarisk
  - Russian thistle
  - Cheat grass
  - Awned barnyard grass
  - Ravenna grass
  - Russian olive



Ecosystem restoration summary



- Rapid colonization of plants in tributaries with water
- Native plants generally dominant on older (>2-3 years) landscapes
- Native shrubs dominant; not much tamarisk
- Species assemblages vary between tributaries
- Hanging gardens establishing after 3-6 years
- Crust establishing after 6-12 years
- Tributaries recovering faster than drying bays

Management concerns: Non-native plants

- Many common non-native species not proliferating, or persisting
  - Tamarisk
  - Russian thistle
- Some species need monitoring to understand spread
  - Ravenna grass
  - Awned barnyard grass
- Active management of select species could be beneficial
  - Russian olive (*Elaeagnus angustifolia*)
  - Relatively uncommon, isolate to specific canyons

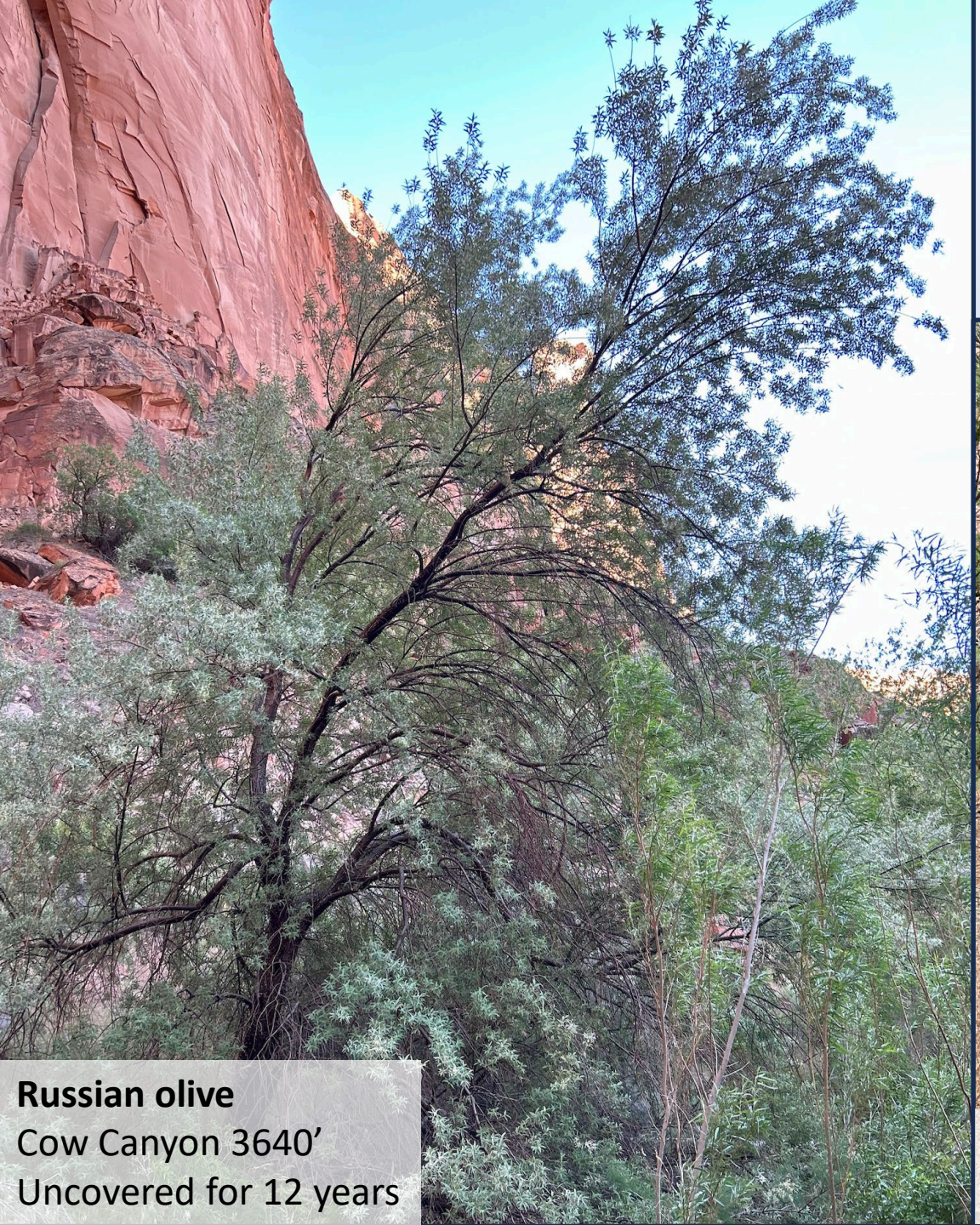
Russian thistle seedlings
Drying bay, uncovered 1 year

Russian thistle
Reflection Canyon, uncovered for 2 years

Dead Russian thistle
Drying bay, uncovered 2-3 years

Ravenna grass
Willow Canyon 3630’
Uncovered for 6 years

Awned barnyard grass
Reflection Canyon, 3545’
Uncovered for 1 year
Bare ground previous fall



Russian olive
Cow Canyon 3640’
Uncovered for 12 years

Tamarisk
Cow Canyon

Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operation of Lakes Powell and Mead

- New guidelines by 2026
- Cost filling Lake Powell
  - Loss of ecological and cultural resources
- Ecological resources below 3700’ should be considered
- A goal is to provide information relevant to land and water management

Acknowledgments

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Glen Canyon NRA

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