Distribution and ecology of sagebrush taxa within portions of the Colorado Plateau

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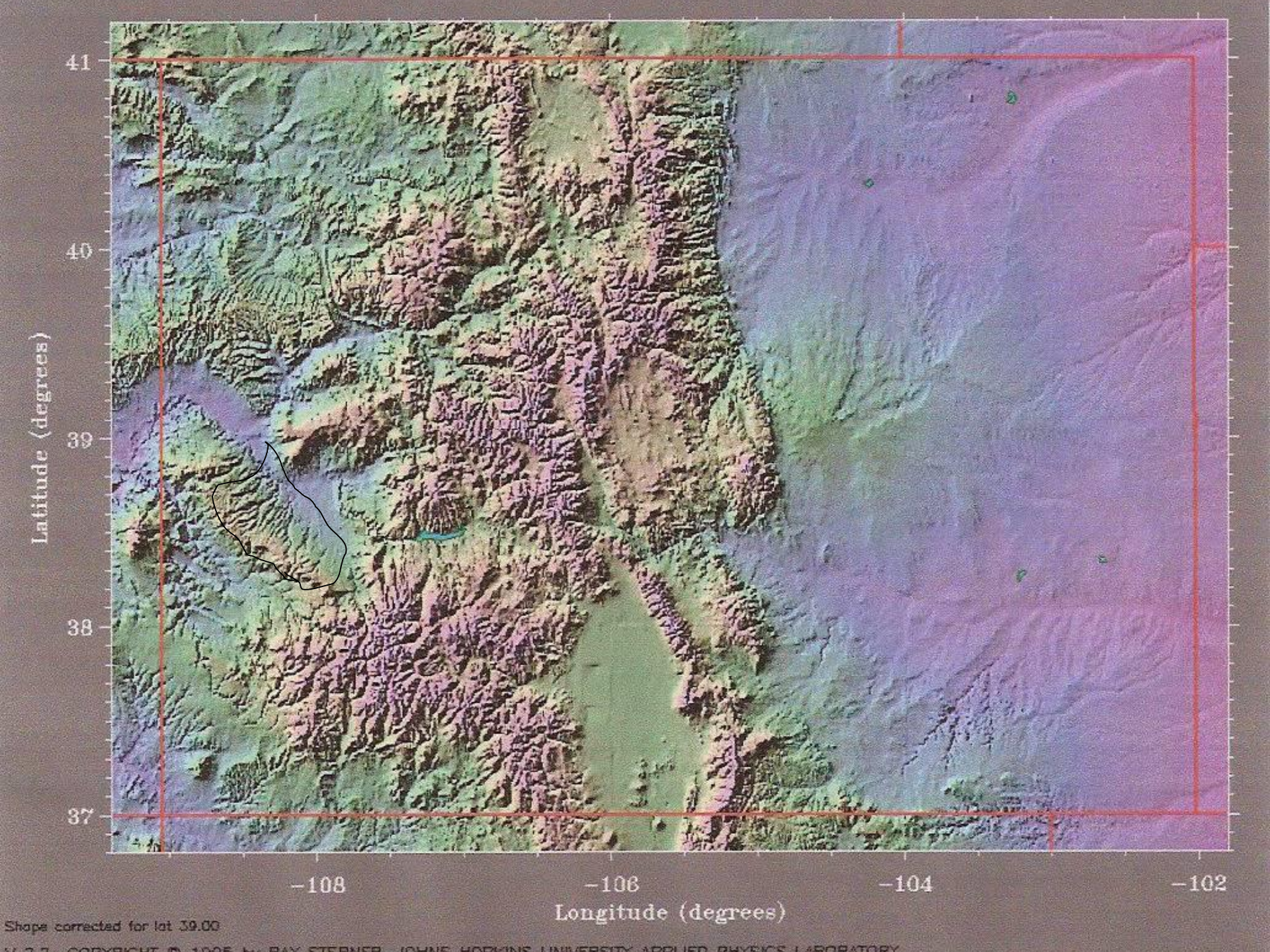
Since sagebrush is such an important plant from ecological and management perspectives it is important to determine the type and even the ploidy (the number of sets of diploid chromosomes in a plant) levels on a landscape scale.

Many sagebrush species include plants and populations with multiple sets of chromosomes.

Differences in ploidy levels may be adaptive and serve to prevent gene flow between plants and taxa at different ploidy levels.

Polyploids can be better adapted to extreme ecological environments than their diploid relatives.



Shape corrected for lat 39.00

Methods

- Lands within the *Uncompahgre Plateau were surveyed* and areas where *sagebrush taxa* occurred *were identified and mapped* using a global positioning system.

- Sagebrush *taxa were identified* on site using *morphological characteristics*.

Methods

- Samples of the leaf material were crushed in water and *viewed under long-wave ultraviolet light* and the amount of florescence if present was recorded to confirm morphological identification.
- The *leaf* material was then *examined using a flow cytometer* (Partec, PA II) to determine ploidy level.
- Sagebrush *taxa*, ploidy levels, and their distribution were *mapped using ARCVIEW*.

Discussion

We were able to identify the taxa and ploidy levels of the sagebrush on 1,099,876 acres of the Uncompahgre Plateau. *We found that some taxa and plants of different ploidy levels grew sympatrically*, while *other grew tightly parapatrically*. However, we found *no compelling evidence of hybridization* even though hybridization is a relatively common event between sagebrush taxa.

We recommend using taxa indigenous to areas proposed for restoration.

Taxa and Ploidy Levels Identified

Arbi - Bigelow's Sagebrush – *Artemisia bigelovii* - 4X
Arca - Silver Sagebrush – *Artemisia cana* – 2X
Arno - Black Sagebrush – *Artemisia nova* - 2X, 4X
Artrt - Basin Big Sagebrush – *Artemisia tridentata spp. tridentata* – 2X, 4X
Artrv - Mountain Big Sagebrush – *Artemisia tridentata spp. vaseyana* – 2X
Artrw - Wyoming Big Sagebrush – *Artemisia tridentata spp. wyomingensis* – 4X

Ploidy Levels Affects on Plant Adaptation

Multiple ploidy levels occur among most species.

The principal base chromosome numbers were x= 8 and x= 9

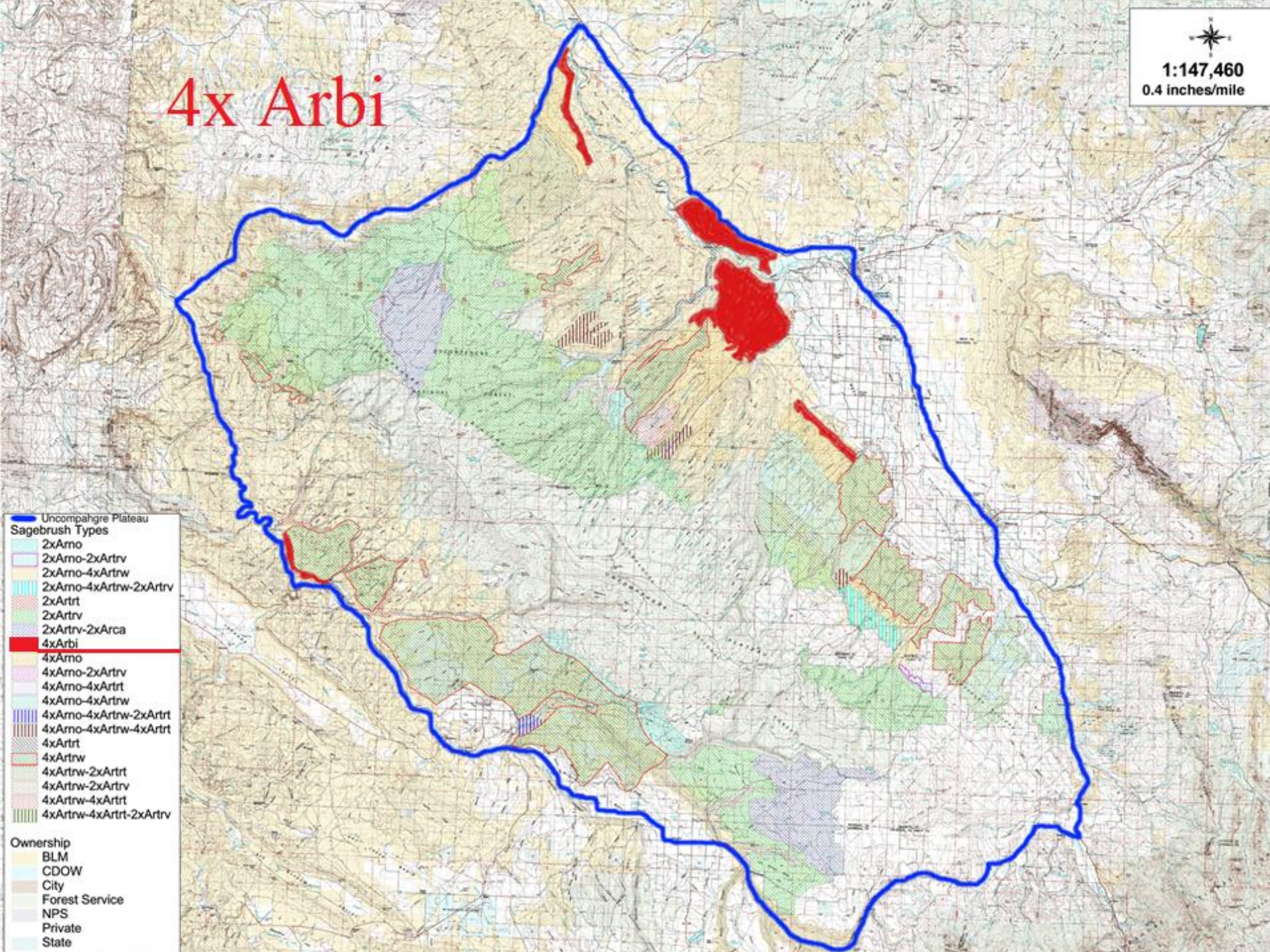
Ploidy levels may be an adaptive strategy

Polyploides better adaptive to ecological extremes than diploid relatives

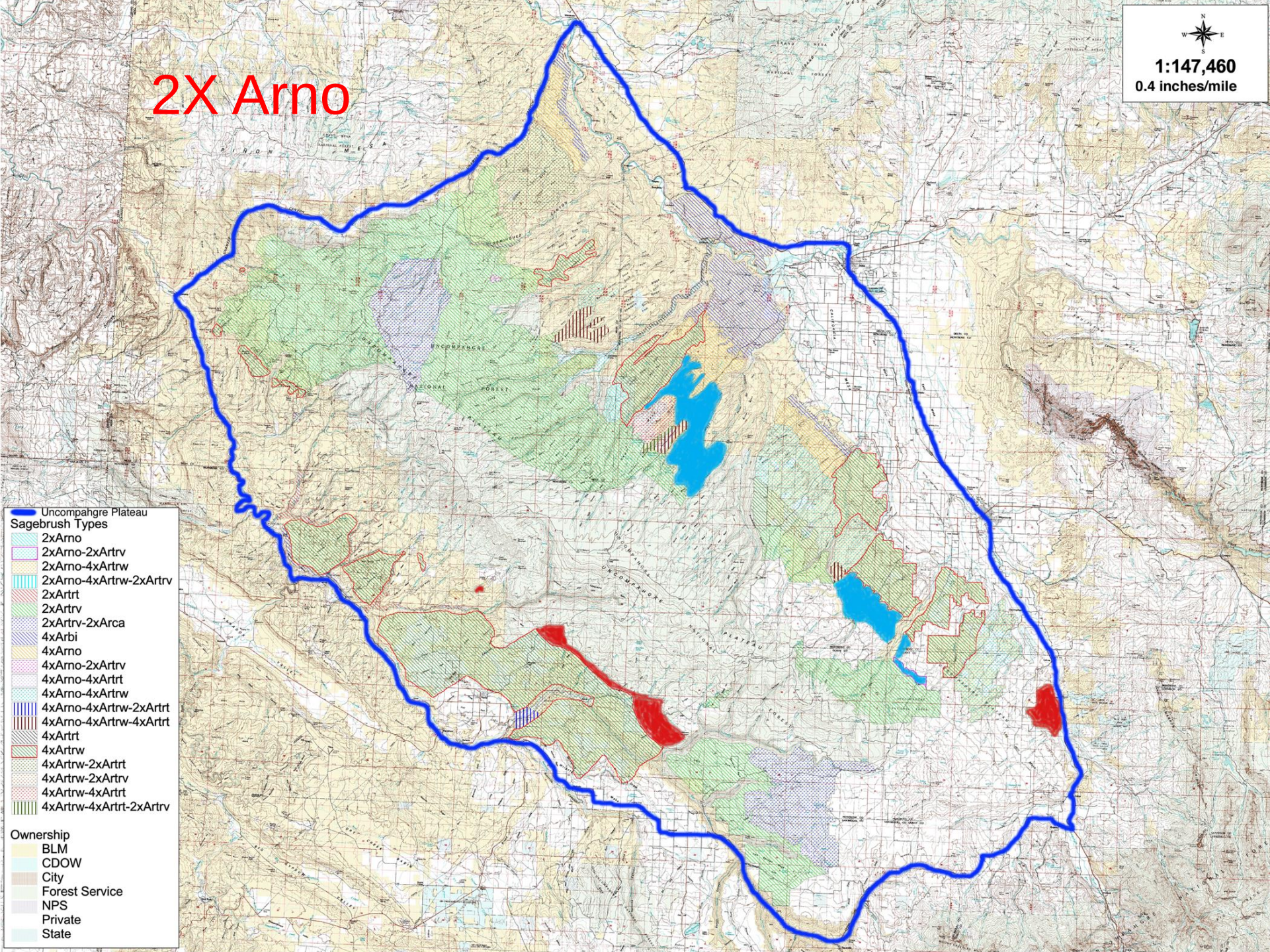
Autopolyploidy alters tolerance

Polyploids are smaller shrubs with lower growth rates & increase drought tolerance. Consequently planting tetraploid (4x) Wyoming big sagebrush on drier sites is recommended.

4x Arbi


1:147,460
0.4 inches/mile
Uncompahgre Plateau
Sagebrush Types
2xArno
2xArno-2xArtrv
2xArno-4xArtrw
2xArno-4xArtrw-2xArtrv
2xArtrt
2xArtrv
2xArtrv-2xArca
4xArbi
4xArno
4xArno-2xArtrv
4xArno-4xArtrt
4xArno-4xArtrw
4xArno-4xArtrw-2xArtrt
4xArno-4xArtrw-4xArtrt
4xArtrt
4xArtrw
4xArtrw-2xArtrt
4xArtrw-2xArtrv
4xArtrw-4xArtrt
4xArtrw-4xArtrt-2xArtrv
Ownership
BLM
CDOW
City
Forest Service
NPS
Private
State


4X Arbi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4xArbi
4xArno
4xArno-2xArtrv
4xArno-4xArtrt
4xArno-4xArtrw
4xArno-4xArtrw-2xArtrt
4xArno-4xArtrw-4xArtrt
4xArtrt
4xArtrw
4xArtrw-2xArtrt
4xArtrw-2xArtrv
4xArtrw-4xArtrt
4xArtrw-4xArtrt-2xArtrv
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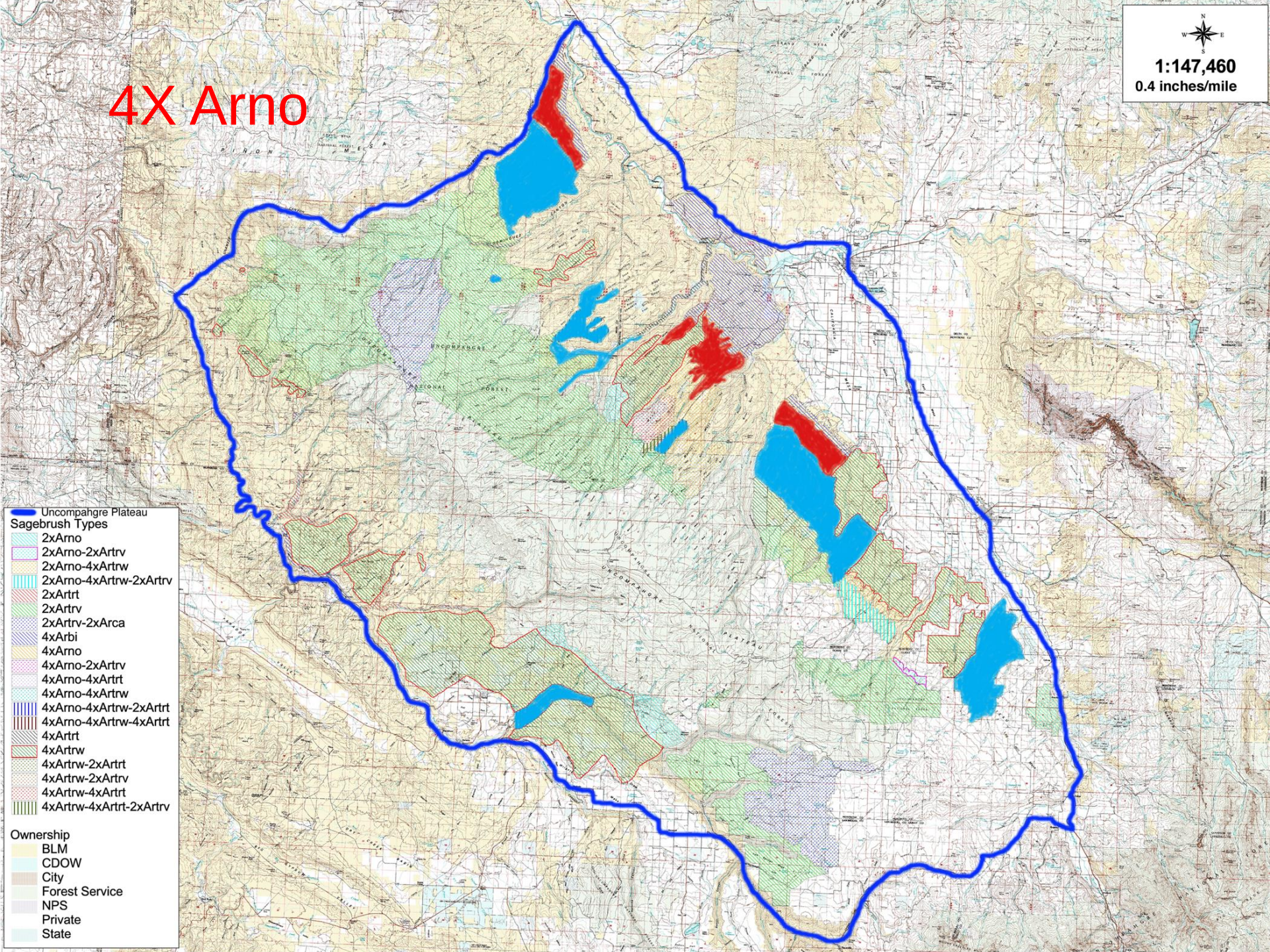
2X Arno

4X Arno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4xArno-4xArtrw
4xArno-4xArtrw-2xArtrt
4xArno-4xArtrw-4xArtrt
4xArtrt
4xArtrw
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4xArtrw-4xArtrt
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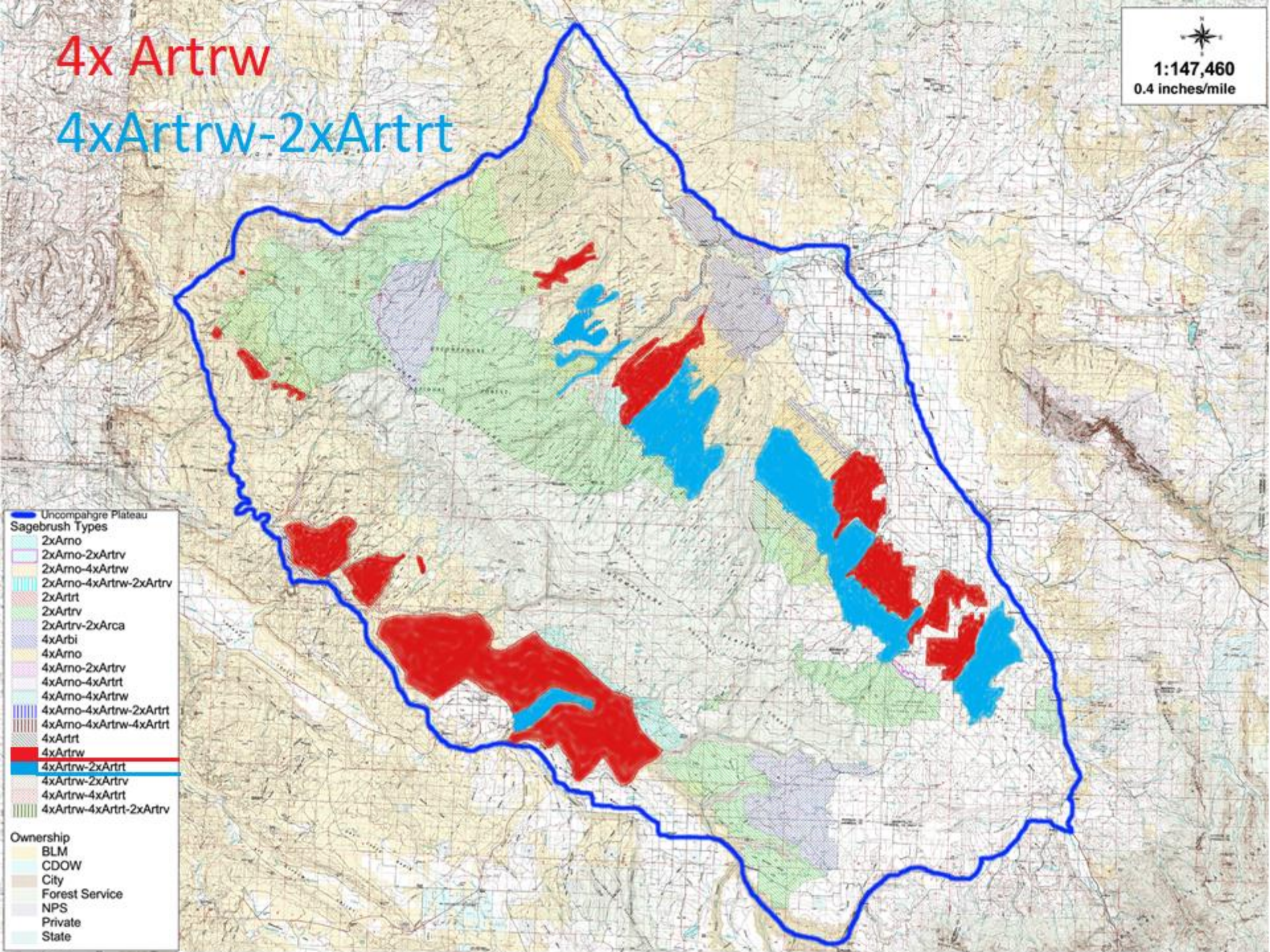
4X Arno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4xArtrw-2xArtrt
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2xArtrv
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4xArbi
4xArno
4xArno-2xArtrv
4xArno-4xArtrt
4xArno-4xArtrw
4xArno-4xArtrw-2xArtrt
4xArno-4xArtrw-4xArtrt
4xArtrt
4xArtrw
4xArtrw-2xArtrt
4xArtrw-2xArtrv
4xArtrw-4xArtrt
4xArtrw-4xArtrt-2xArtrv
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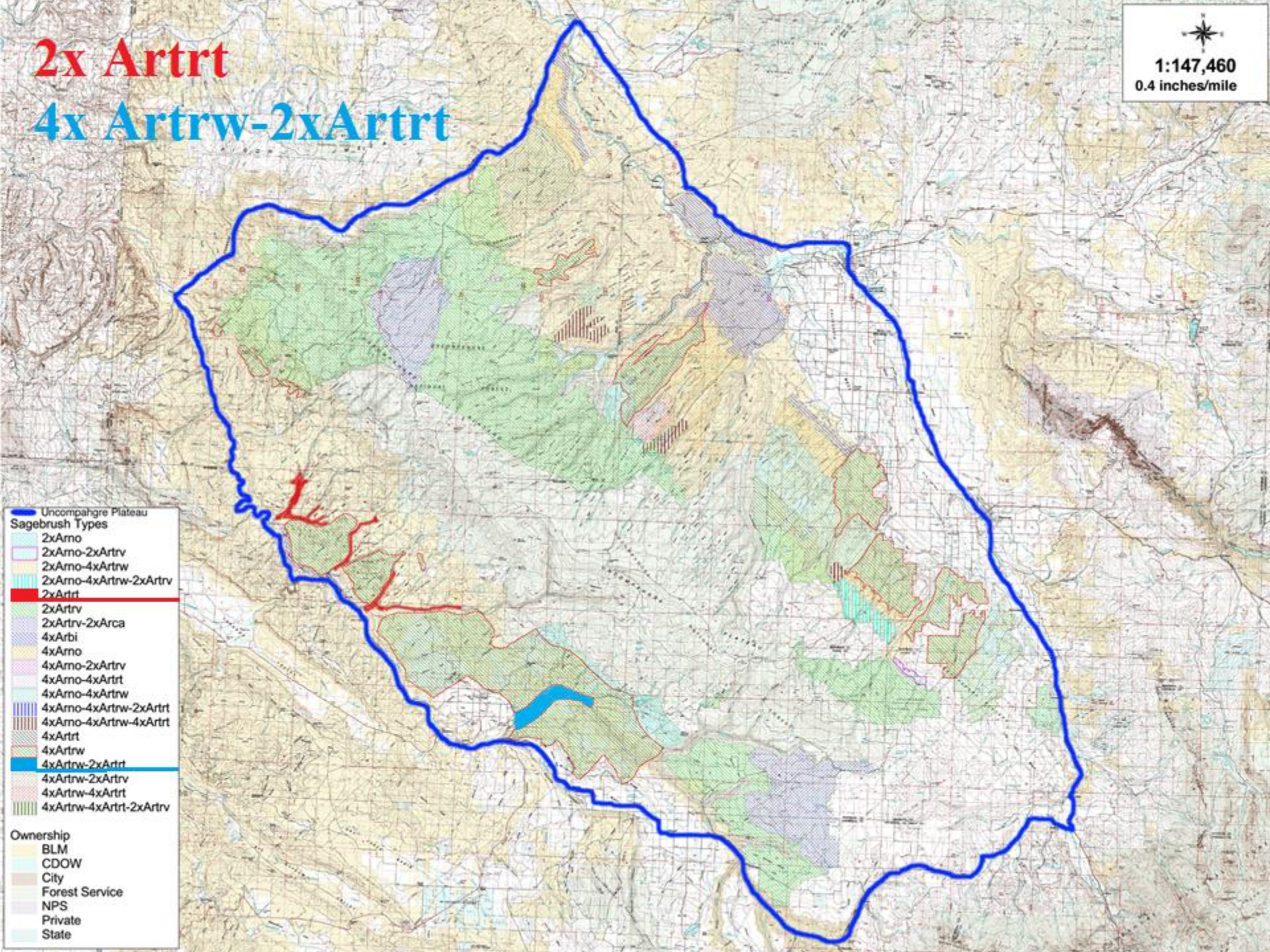
4X Artrw

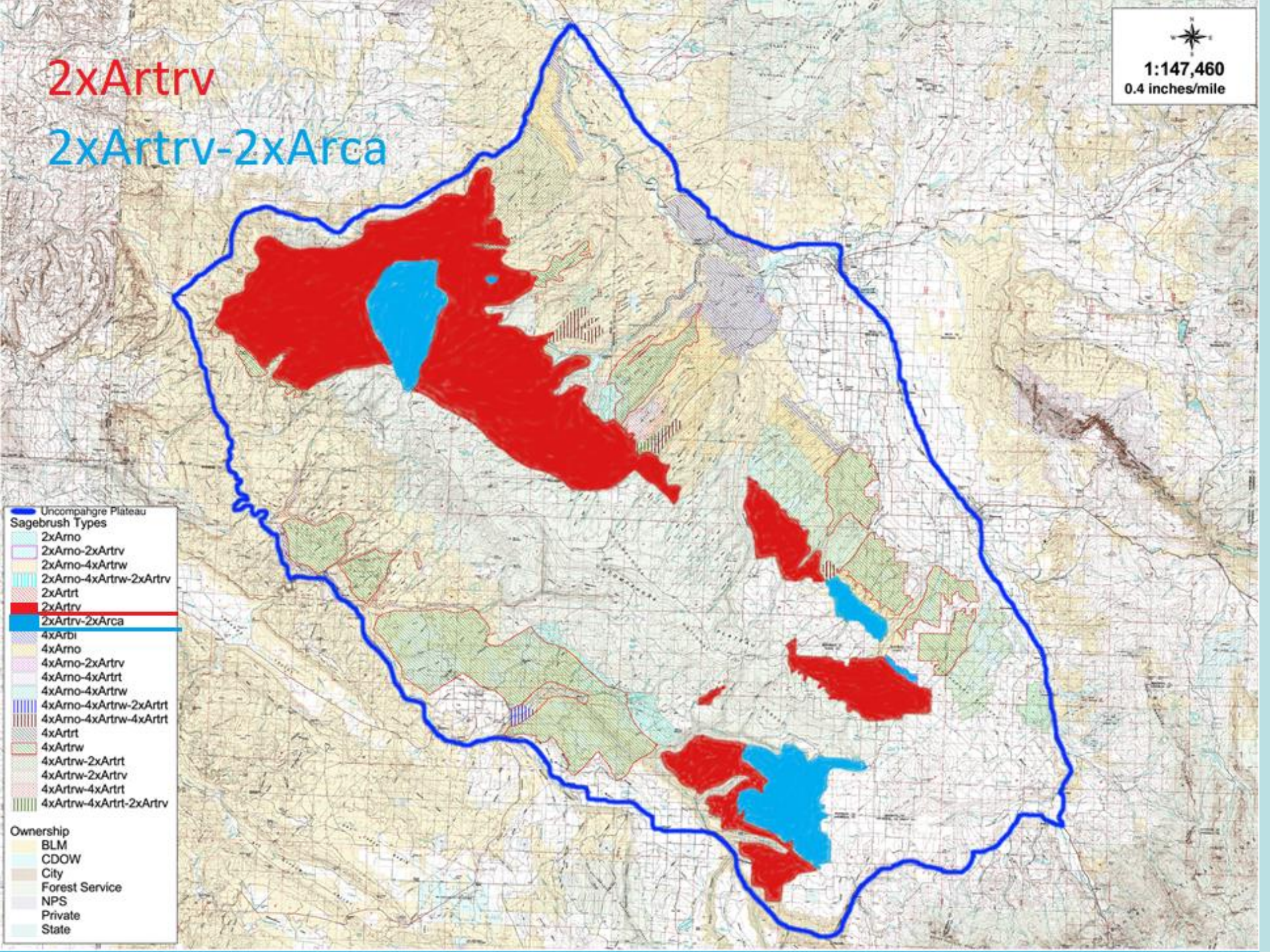
2x Artrt

4x Artrw-2xArtrt




2X Artrt

4X Artrt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4xArbi
4xArno
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4xArno-4xArtrt
4xArno-4xArtrw
4xArno-4xArtrw-2xArtrt
4xArno-4xArtrw-4xArtrt
4xArtrt
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4xArtrw-4xArtrt
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2X Artrv


2X Arca

Seed Germination-Habitat Correlated

- Germination rate correlated to mean Jan. temperature
- Population from cold winter sites-
    - Require mechanisms to reduce fall germination
    - Requires long periods cold chilling (2-4 weeks)
    - 20 week chill removes all dormancy
    - Slow germination (>10 days to 50% germination)
    - Light limits germination-100% light requiring
- Germination at near-freezing is slow
    - (100 days to 50% germ)
- Germination occurs beneath the snowpack
    - Risk from premature germination reduced
    - Slower germination increases survival
    - More favorable soil moisture and temperature conditions

Germination Scenarios-Warm Habitats

- Winter conditions optimal for establishment
- Early emergence is an advantage
- Seeds are non-dormant, but respond rapidly to chill treatments
- Rapid germination (50% germ. within 10 days)
- Less light requiring-only 50-75% light requiring
- Shallow buried seeds with light requirement amount to small carryover