The recent appearance and successful eradication of barbed goatgrass (*Aegilops triuncialis*) at a Southern California nature preserve

AND

Recent Expansions (Explosions!)

California Invasive Plant Council

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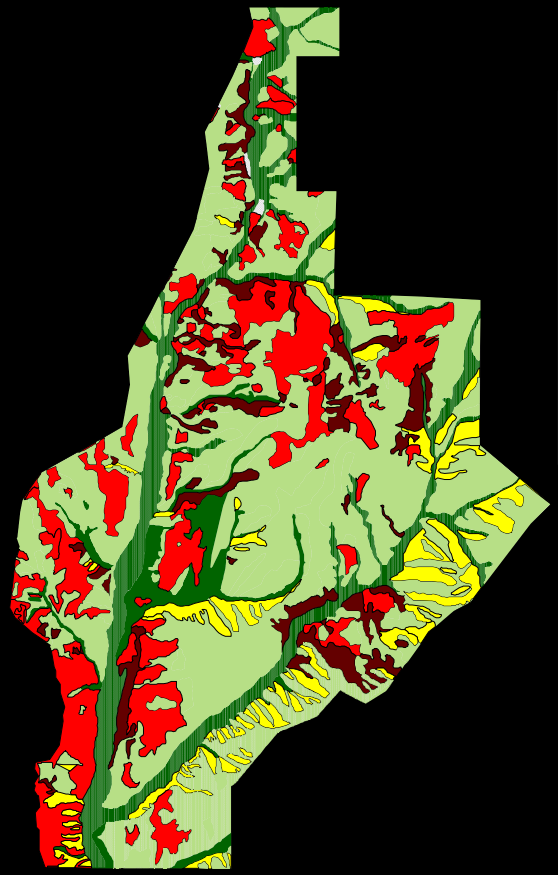
Audubon Starr Ranch Sanctuary

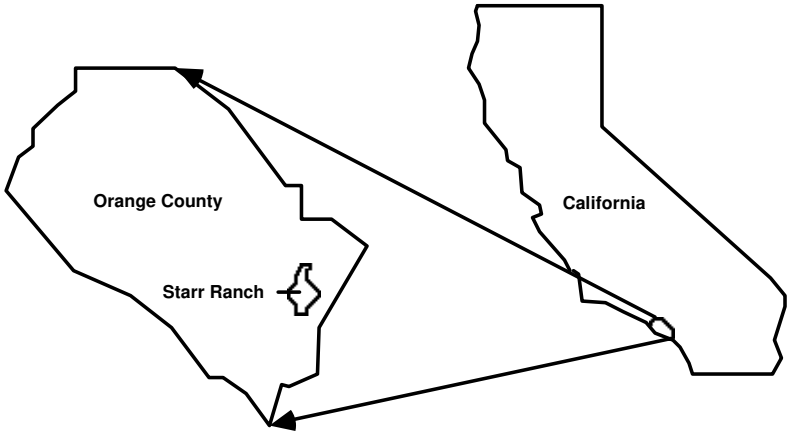
Audubon CALIFORNIA

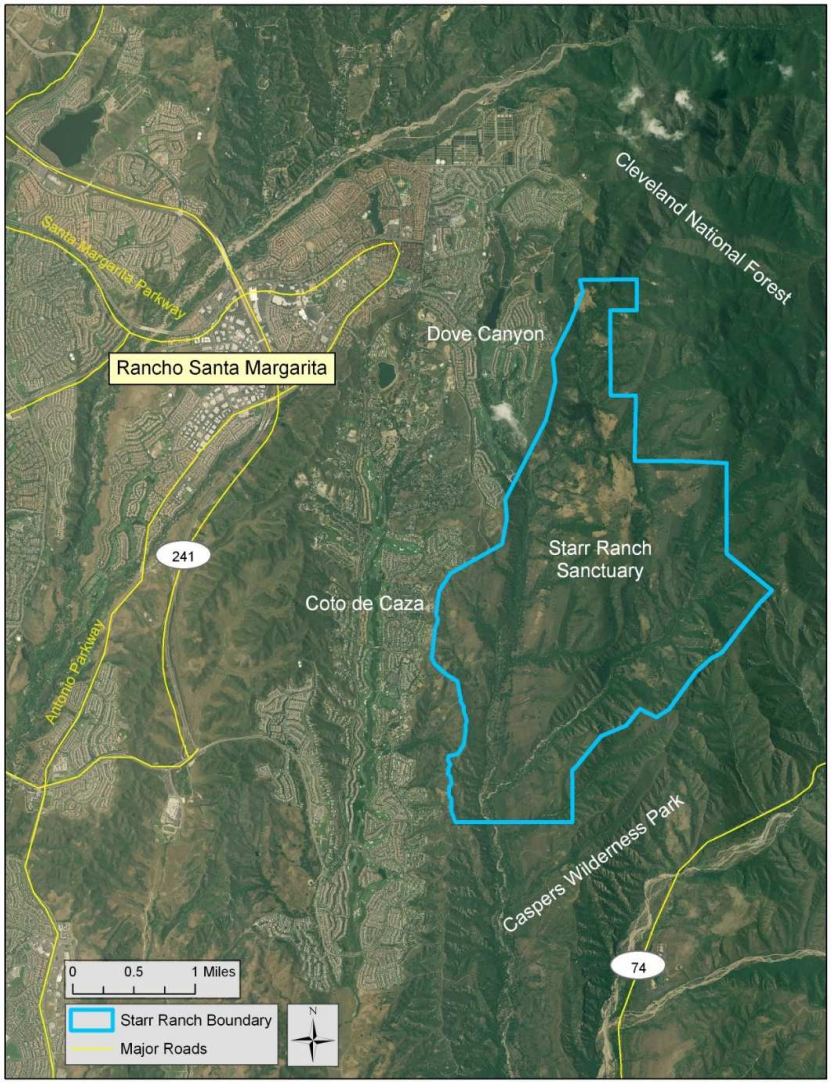


Starr Ranch Vegetation

Habitat Types

- Oak Woodland
- Coastal Sage Scrub
- Riparian Woodland
- Grassland
- Chaparral


Orange County
California
Starr Ranch

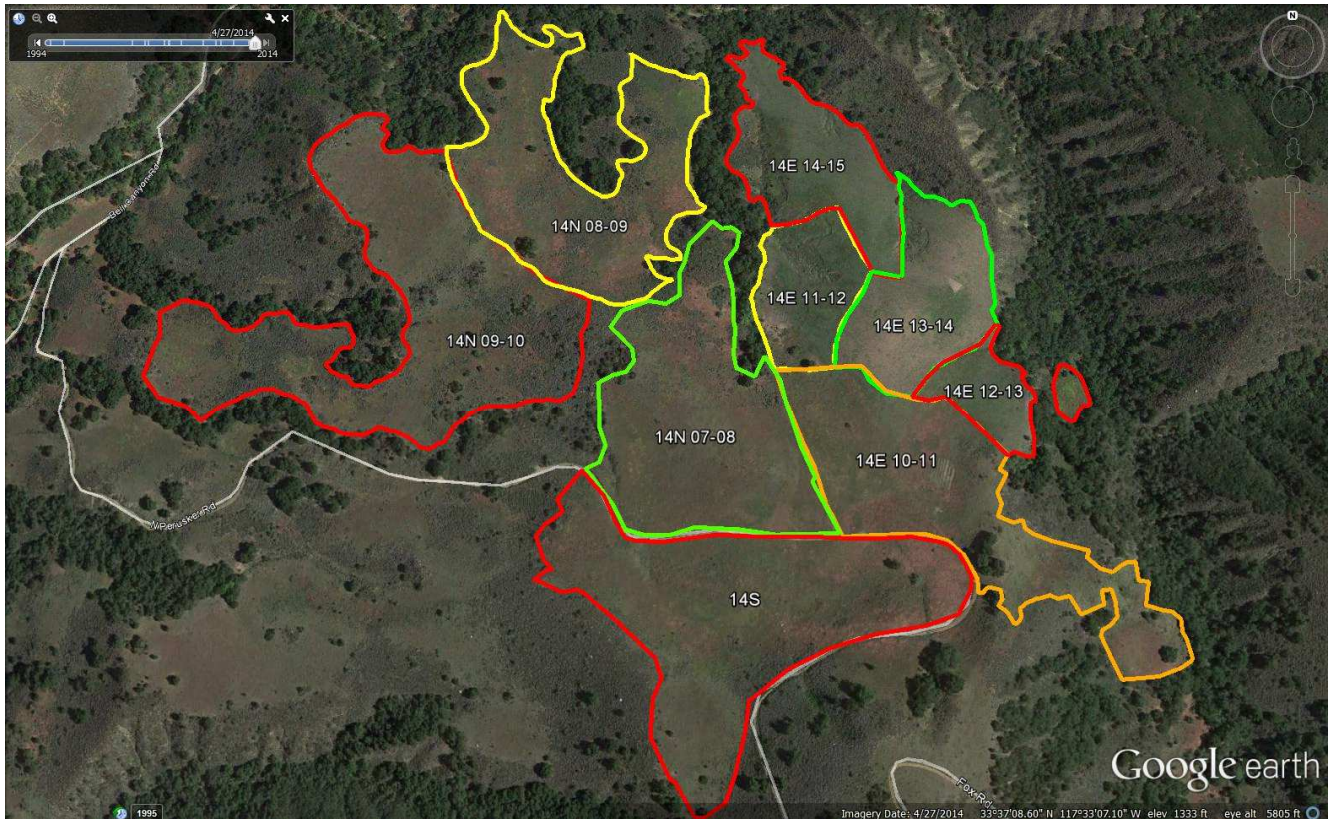

Cleveland National Forest
Santa Margarita Parkway
Dove Canyon
Rancho Santa Margarita
241
Starr Ranch
Sanctuary
Coto de Caza
Antonio Parkway
Caspers Wilderness Park
74
0 0.5 1 Miles
Starr Ranch Boundary
Major Roads
N

Starr Ranch Land Management

- ***Influenced practice on 200,000 acres preserved land - Ventura to San Diego Counties (visitation and solicited advice)***
- ***"cutting edge" (U.S. Fish and Wildlife Service)***

Barbed Goatgrass Control Site: Grassland 14

60 acres moderate (30-40%) cover *Stipa pulchra*




Highest priority upland nonnative: artichoke thistle, *Cynara cardunculus*
Invaded 720 acres disturbed grassland
Over series of 3 experiments learned how to reduce cover by 95% in work site after one season

Site 14 Baseline 2007

Site 14

No control (yet)

After one season control

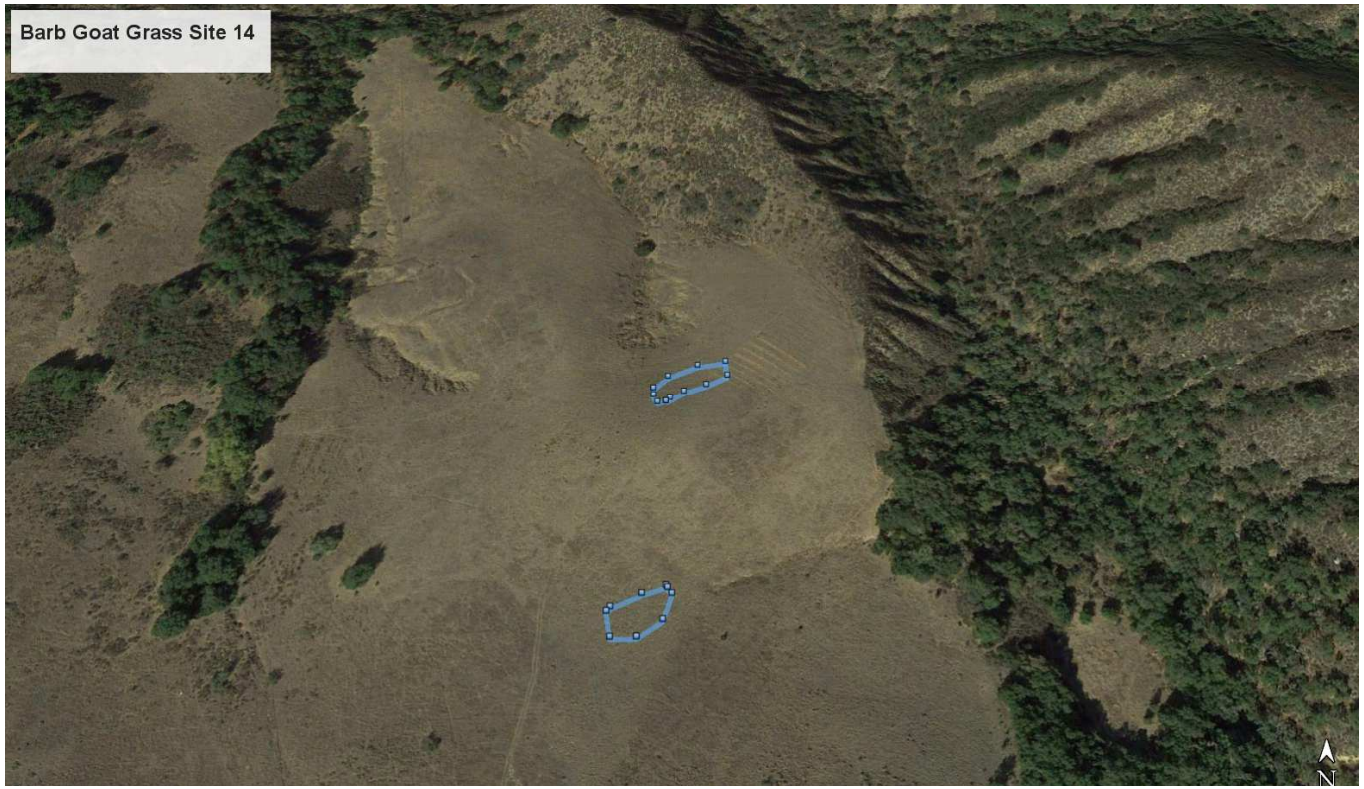
By 2015, all 60 acres under nonchemical control, *Stipa pulchra* restoration initiated BUT

2017 first observation: barbed goatgrass patches (0.22 acres)

No goatgrass on Starr Ranch until 2017

Hypothesis: former staff visited from NorCal, walked site 14

Sparse purple needlegrass (*Stipa pulchra*) in both goatgrass patches



Reported occurrence to our OC botanist guru, Ron Vanderhoff
First observation in Orange County

Calflora Search for Plants

Aegilops triuncialis

Goatgrass

invasive non-native

Annual grasslike herb

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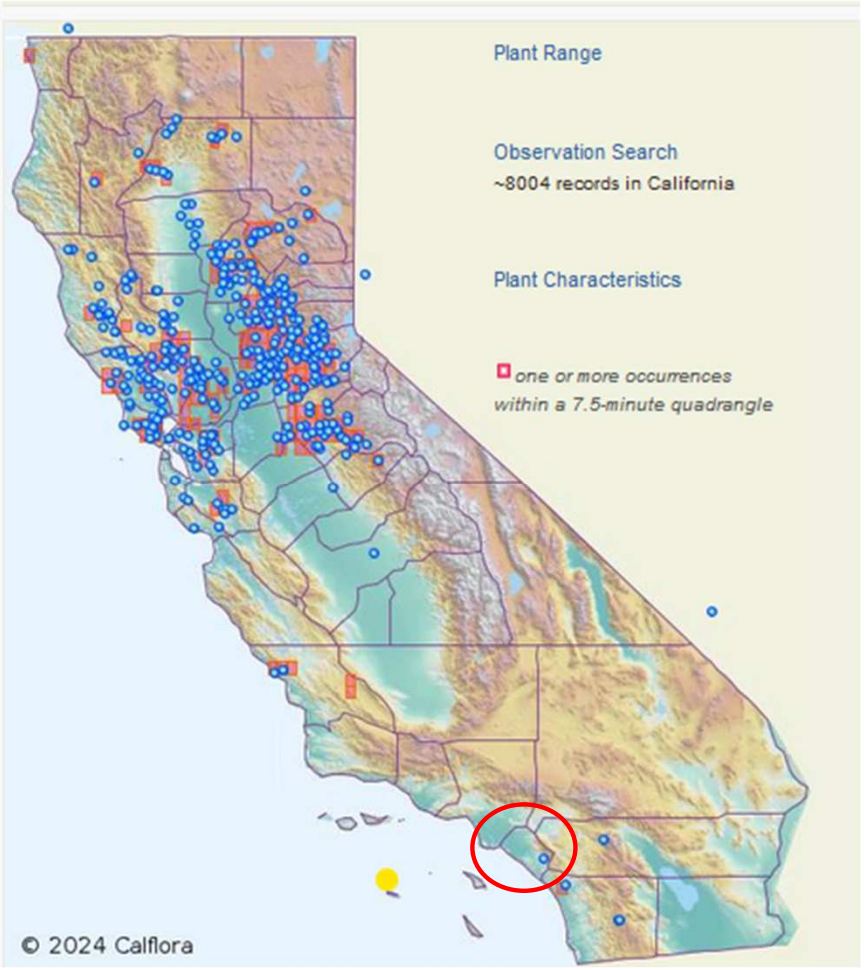

EDRR

New Invasive Nonnative: Our Process

1. **Literature review**
2. **Experiments and informal trials if nonchemical methods not in literature or online**
3. **Detailed goatgrass methodologies in literature, online**
4. **Devise a protocol for control**
5. **Start work**

Barbed Goatgrass (*Aegilops triuncialis*)

Invasive non-native annual grass

Cal-IPC rating: high impacts

Winter annual

Defoliation prior to seed head emergence limits seed production

Mow after the onset of the R4 stage – i.e. after awns emerge.

Mow over a five week period May to early June but earlier in warmer drier areas of CA

Nonchemical control: literature review

Table 2. Range and length of time when the optimal grazing or mowing treatment window for barb goatgrass and medusahead will likely occur in California annual grasslands

Treatment	Plant stage	Observed treatment timing range*	
		Barb goatgrass	*Medusahead*
grazing	V3 to R4	2 to 3 weeks† in March to May	*2 to 3 weeks in early April to May*
mowing	R5 to R8	5 weeks in May to early June	*5 weeks in late April to early June*

Notes:

*Timing in warmer and drier locations will likely be earlier than in the cooler and moister locations.

†Targeted grazing for barb goatgrass would theoretically occur during this period, but we cannot recommend this as an effective treatment since sufficient research is currently not available showing this to be effective.

Nonchem control: the R4 grass stage

After onset R4 stage, reduced recovery from defoliation

Mowing at R4 very successful treatment

Anthers emergence good indicator for mowing initiation

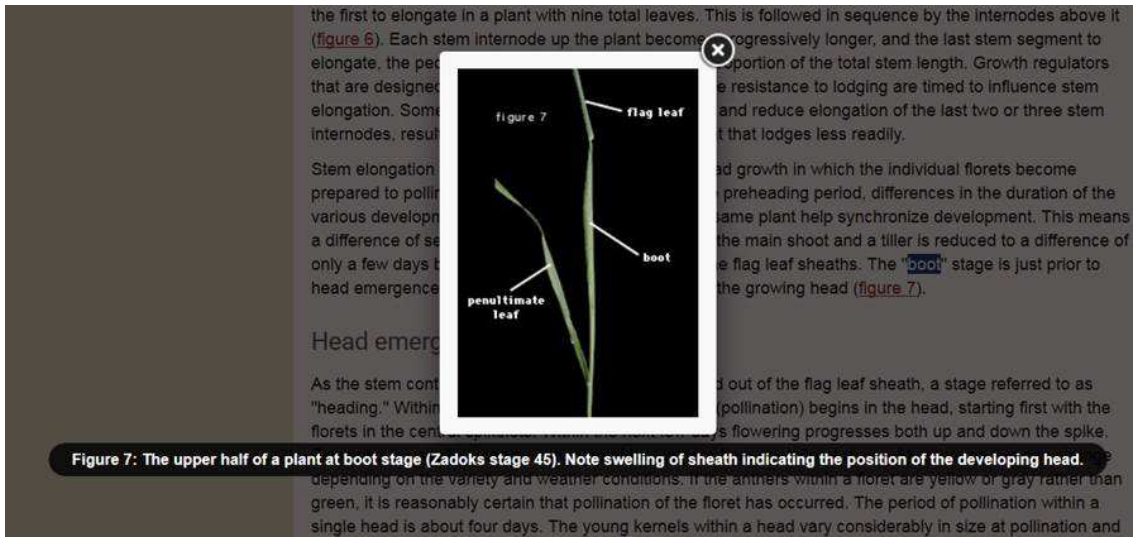

Figure 7: The upper half of a plant at boot stage (Zadoks stage 45). Note swelling of sheath indicating the position of the developing head.

Table 1. Phenological stages of medusahead and barb goatgrass in California annual rangelands

Stage	Description	Season*
V1	Germination occurs at the onset of fall rains (roughly 0.5–1 inch of rain within 5 days) followed by growth of the seed leaf.	fall
V2	The early vegetative stage occurs with shortened day length. Lower temperatures during the winter may inhibit growth and last for months.	fall–winter
V3	The late vegetative stage occurs as temperatures increase in the late winter and early spring, characterized by lengthening internodes and transition into the boot stage. This stage indicates the start of the spring growing season and quicker growth and development.	late winter to early to mid-spring
R4	Emergence of awns through the full emergence of the inflorescence.	mid to late spring
R5	The florets open and anthers emerge (anthesis).	late spring
R6	Anthesis ends and kernels begin to form.	late spring
R7	Kernels elongate to reach the full length of the palea.	late spring
R8	Seeds in the milk stage and kernels occupy the full length of the palea. Seeds will continue to mature and become viable if cut off.	very late spring
R9	Seeds in dough stage.	very late spring
M10	All seeds are mature and hard. The plant is not yet dead, though there is some red, brown, and green in the seed heads. Glume veins are dark.	early summer
D11	Seeds fully mature. Flowering stem is dead and dry. The whole plant is a reddish-yellow (barb goatgrass) or uniform sandy-yellow color (medusahead). This stage includes seed head shatter and seed dispersal.	early summer
L12	Plant material from the previous year is leached of nutrients, leaving gray plant material (typically medusahead has much more litter in this stage than other annual grass species).	fall–winter

Source: Adapted from NRC 1982; George and Bell 2001.

Nonchemical Control

Starr Ranch Strategy

Baseline May 17, 2017: Map goatgrass populations.

2017-18:

In (March, April) and early May or June, check for emergence of goatgrass awns and/or anthers. As soon as awns and/or anthers are observed:

Locate ± equal areas for two brush cutting treatments in GG patches. Locate 2 X 2 m patch for black plastic.

T1: Brush cut to bare ground, repeat monthly

T2: Brush cut to 4-6", repeat monthly

T3: Brush cut and cover 2 X 2 m area with black plastic fastened in place with landscaping pins (leave a margin so light can't get in)

Nonchemical Control

Starr Ranch Strategy, continued

Repeat treatments for two seasons (leave black plastic in place), 2017-18 and 2018-19.

For possible seeds dispersed out of patches, at each visit check in a 2 m buffer around the patch and pull any new individuals as soon as identifiable.

Audubon is About Birds

Two Songbird Indicators Grassland Habitat Quality

Grasshopper Sparrow
Ammodramus savannarum

Western Meadowlark
Sturnella neglecta

Dilemma: Four Grasshopper Sparrow Territories in Work Site

Brush cutting timing occurs during nests with young

Advice from Audubon CA Director of Bird Conservation, Andrea Jones:

Search through the grassland for birds, nests

Goatgrass not near nests, whew!

Nonchemical Control: Results

Goatgrass gone by end of second season

Ron Vanderhoff wanted to come visit to see goatgrass – sorry, none left!

But we remain watchful

Stipa pulchra Enhancement in GG Control Areas

STIPUL Seeding and Plug Planting

In summer 2018, design and build a small nursery for growing STIPUL plugs

October, repeat till to reduce non-natives and prep *Stipa* seeding strips through first wetting rains

Seed STIPUL at experimentally determined rates ** below.

Use normal soil prep protocol but lightly rake caryposes to cover with a little soil then tamp.

In December or January when soils is wet, plant STIPUL plugs at low density (3 plugs per sq m).

** **20 lbs per acre** = 8.8 g/2.2 g/ 1 sq m plot

STIPUL plugs in nursery

Strips for planting

Photomonitoring

Baseline

April

2018 On: No goatgrass observed on Starr Ranch

Native bunchgrass restoration continues

Grasshopper Sparrows singing during breeding season

But weed wars continue

Invasive Species Explosions 2023-24

Average Orange County annual rainfall ± 15 inches

2022-23 season total rainfall 30 inches

2023-24 season total rainfall 20 inches

Worst invasive species fighting season in 27 years of land management

Fountain grass
Cenchrus setaceus

Oxtongue
Picris echiodes

Bull thistle
Cirsium vulgare

Sow thistle
Sonchus spp

English plantain
Plantago lanceolata

Land management in a changing climate requires

But we've always thought OUT OF THE BOX

Strategy to maintain sanity 2024 on

1. Continue
    - Research and monitoring
    - Non-chemical, targeted invasive control
    - Accepting some non-natives with positive or neutral effects on natives (different talk!)

2. Stay positive – how I stay positive
    - Interesting research on extreme events
    - Walk where there are wildflowers