

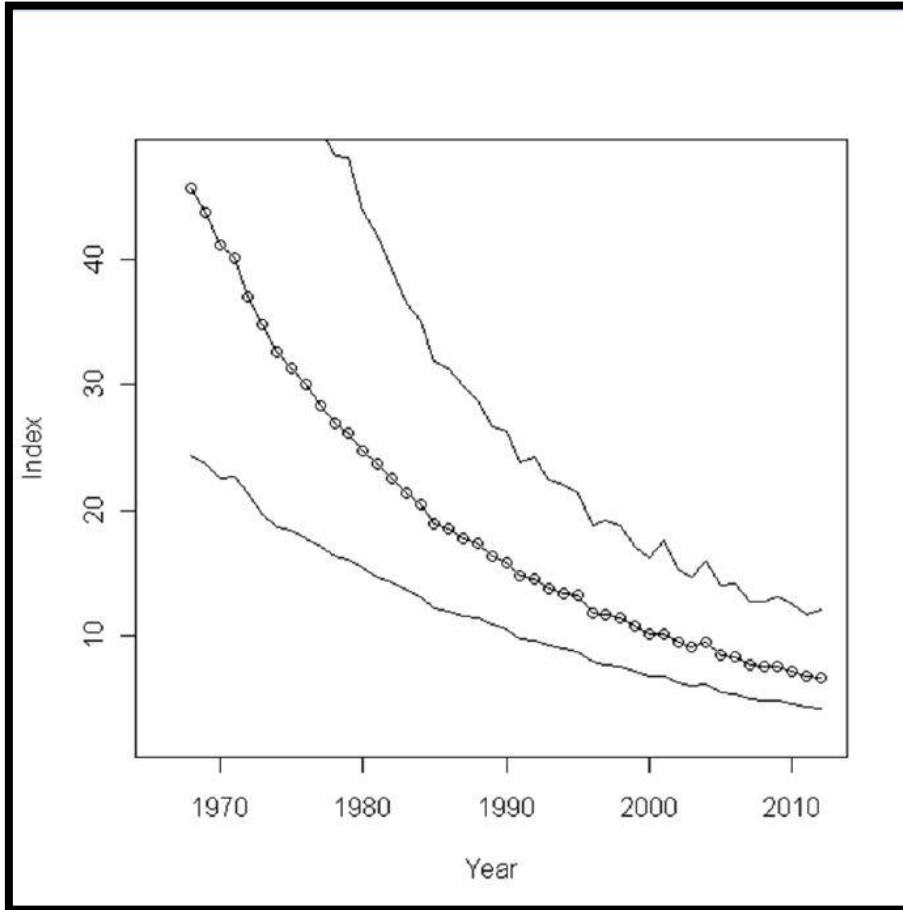
PINYON JAY SURVEY PROTOCOL

COLORADO PARKS AND WILDLIFE



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Why are surveys needed?

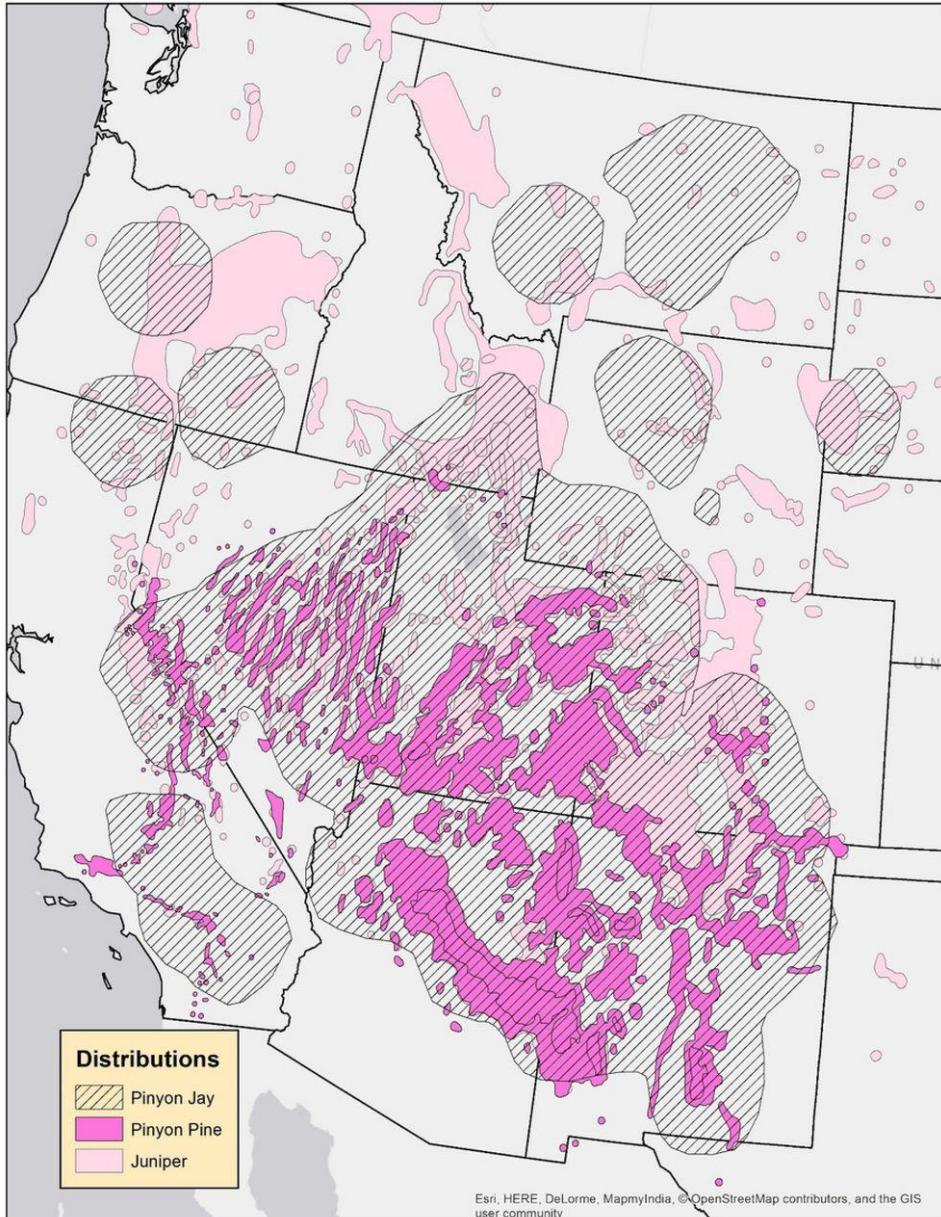


- Breeding Bird Surveys (BBS) over the past 50 years indicate steep population decline
- Ranked as a Species of Greatest Conservation Concern (Tier 1) in Colorado's 2025 State Wildlife Action Plan
- 12-month status review for listing under the USFWS Endangered Species Act. Decision due in 2028.



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Pinyon Jay Range



John D. Boone, Chris Witt, Elisabeth M. Ammon 2021

- Pinyon-Juniper woodlands occur in arid regions at elevations typically from 4,900 to 8,000 feet in CO
- 21% of the forested landscape in Colorado
- Pinyon-juniper woodlands generally transition from grasslands or shrublands at lower elevations
- Pinyon jays uniquely adapted to a mutualistic relationship with the Pinyon Pine tree (*Pinus edulis*)



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Conservation Concerns

Woodland management

- Sage-grouse
- Big Game
- Fuels Reduction
- Forage Production
- Ecosystem Restoration

Climate change

- Long term drought
- Insect outbreaks
- Loss of mast crops

Nest Predator

- common raven



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Co-EVOLVED WITH PINYON PINE TREE

Pinyon Jay Morphological Adaptations

- Expandable esophagus to hold up to 56 pinyon pine nuts. A Scrub-Jay can only hold 3–5.
- Large pointed bills for opening cones
- The pinyon jay bill is featherless at its base (genus *Gymnorhinus* – naked nose). All other corvid species nares covered by bristle-like feathers.



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Pinyon Pine Adaptations



- Large wingless seeds require dispersal by animals
- Seeds are highly nutritional
- Cones open upwards for easy access
- Cones take 3 years to mature
- Trees can produce mast crops every 7 to 10 years – making this unpredictable resource



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Pinyon Jay Behavioral Adaptations

- Long distance dispersal of seeds
 - An Individual jay can cache more than 20,000 seeds in a single season
 - Incredible spatial memory can recover 95% of seeds cached
 - The remaining 5% are able to germinate and grow new trees
- 



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Cache Sites

- Jays cache seeds in open sites such as grasslands, burned areas, shrublands, and sagebrush parks
- Cache sites provide micro habitats favorable for germination
- Can re-plant a woodland impacted by drought, fire, insects or clearing



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Pinyon Jay Seasonal Behaviors

FALL

Pinyon cones begin to ripen in August. Pinyon Jays spend their days collecting pinyon nuts or other foods for caching. Flocks can coalesce to find food.

WINTER

Seed crop becomes depleted, juveniles disperse and the flock roams widely to find seed sources.

SPRING

Breeding begins and birds stay close to colonies. Flock breaks up into breeders and non-breeders. **Spend 40-50% in breeding colony.**

SUMMER

Splintering of flock into independent feeding aggregations. Young gather into a crèche. Annual molt signals end of breeding season.



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Breeding Colonies

- One of our earliest nesting Passerines - courtship begins in mid-February
- During courtship jays very active and noisy. Best time to locate colonies.

- Pairs are monogamous during breeding season. Travel in pairs.

- Young birds can help feed nestlings and guard fledglings. Young birds usually stay in flock.



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Breeding



- Both male and female build nest. Females line nest. Can find nests by following pairs.
- # of eggs laid varies 2-5 depending on food availability; most commonly 4
- In poor mast years jays may forego nesting but can be found in a colony area.



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Breeding



- Male will be a silent guard over female as she lays eggs
- Male feeds female near nest during incubation
- Female incubates eggs for 17 days
- Female broods for 8-10 days after which both male and female feed nestlings



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Breeding



- Nestlings fledge around 22-24 days.
- Fledglings are accompanied by parents and yearlings – can make a very raucous group!
- Soon after fledging, family groups leave the colony area into the surrounding habitat



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Importance of Identifying Colonies

PIJAs have high site fidelity to colony areas

- Important to map colonies to conserve, protect, and manage



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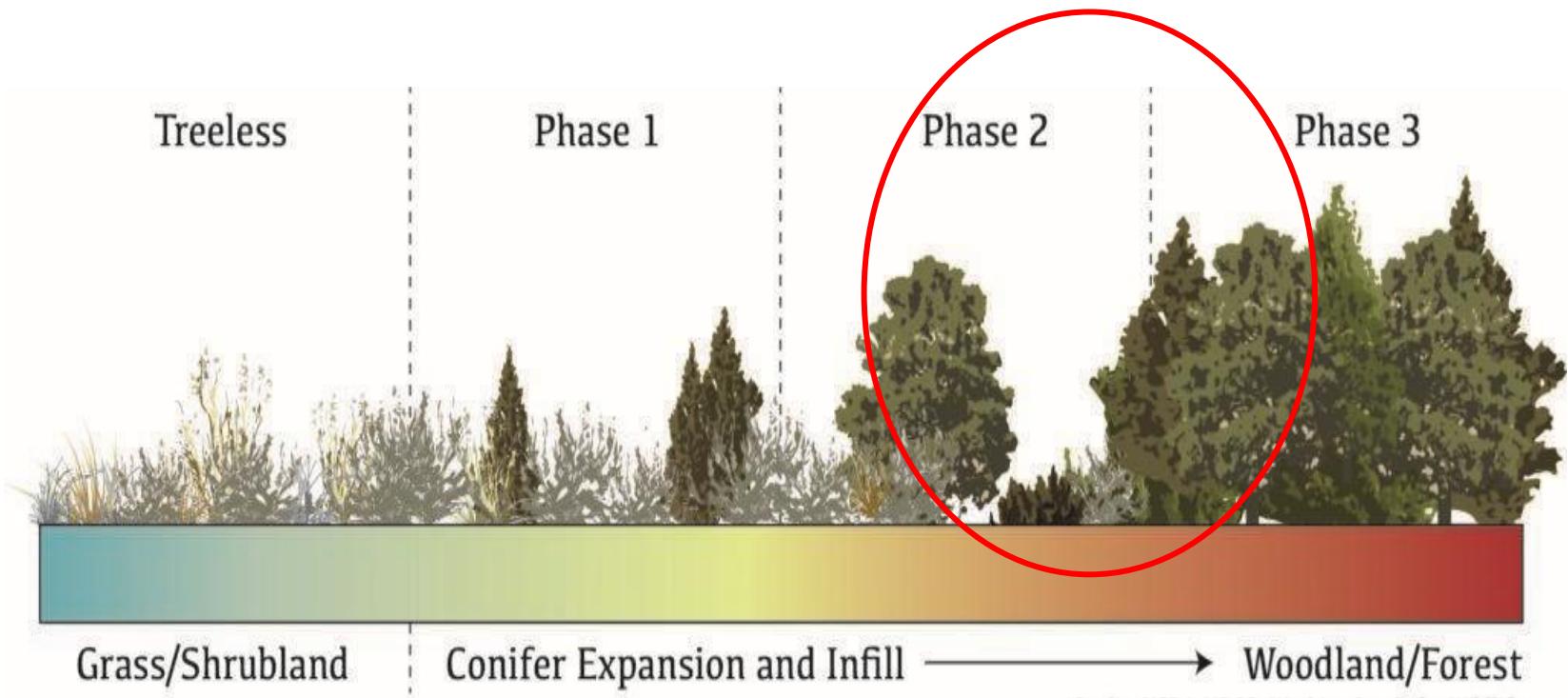
Recent Findings from New Mexico (Johnson et al. 2018)

- Reduction of tree density, canopy cover, and patch size in treated areas appeared to reduced habitat quality and resulted in pinyon jays avoiding nesting in treated areas.
- Pinyon jays did nest near treatment polygons suggesting they avoided treated areas but do prefer to stay in traditional colonies if suitable habitat remains
- The increase in fragmentation and reduction of patch size exacerbated the edge effect possibly increasing risk of predation on nests



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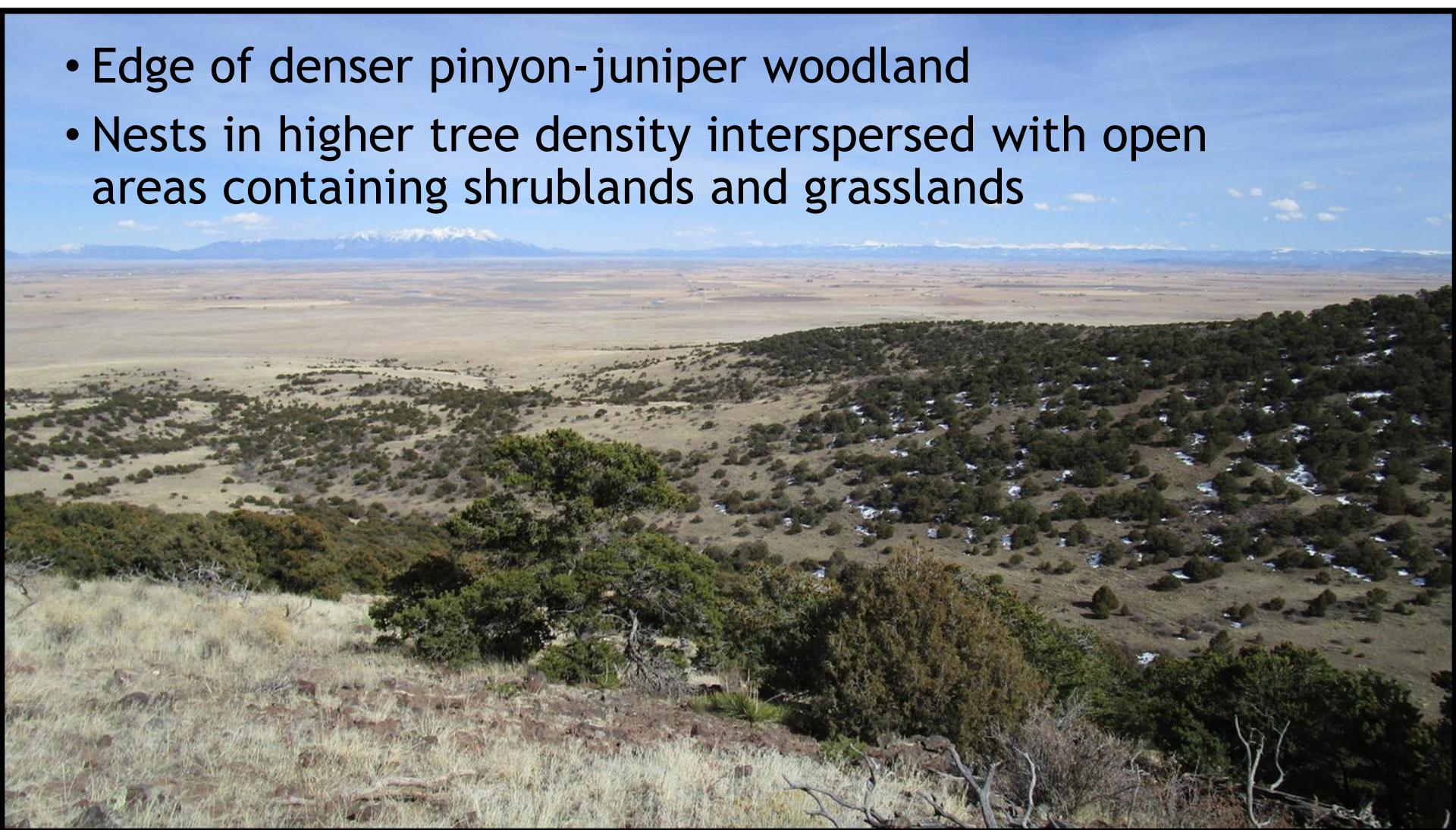
Where we have found Pinyon Jay Colonies



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Breeding Habitat

- Edge of denser pinyon-juniper woodland
- Nests in higher tree density interspersed with open areas containing shrublands and grasslands



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BREEDING HABITAT

- Most colonies not located within dense closed canopy woodland



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Some colonies found with higher tree densities
still close to openings and shrubland interspersion



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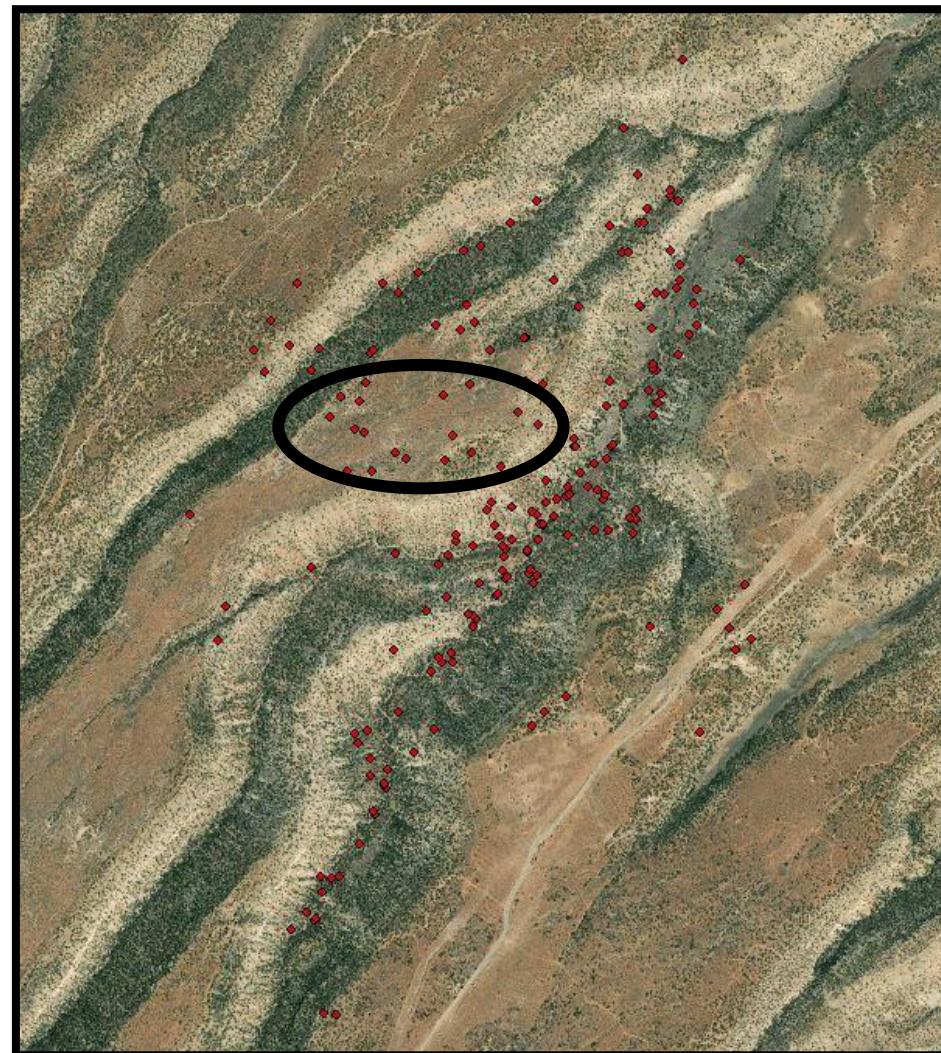
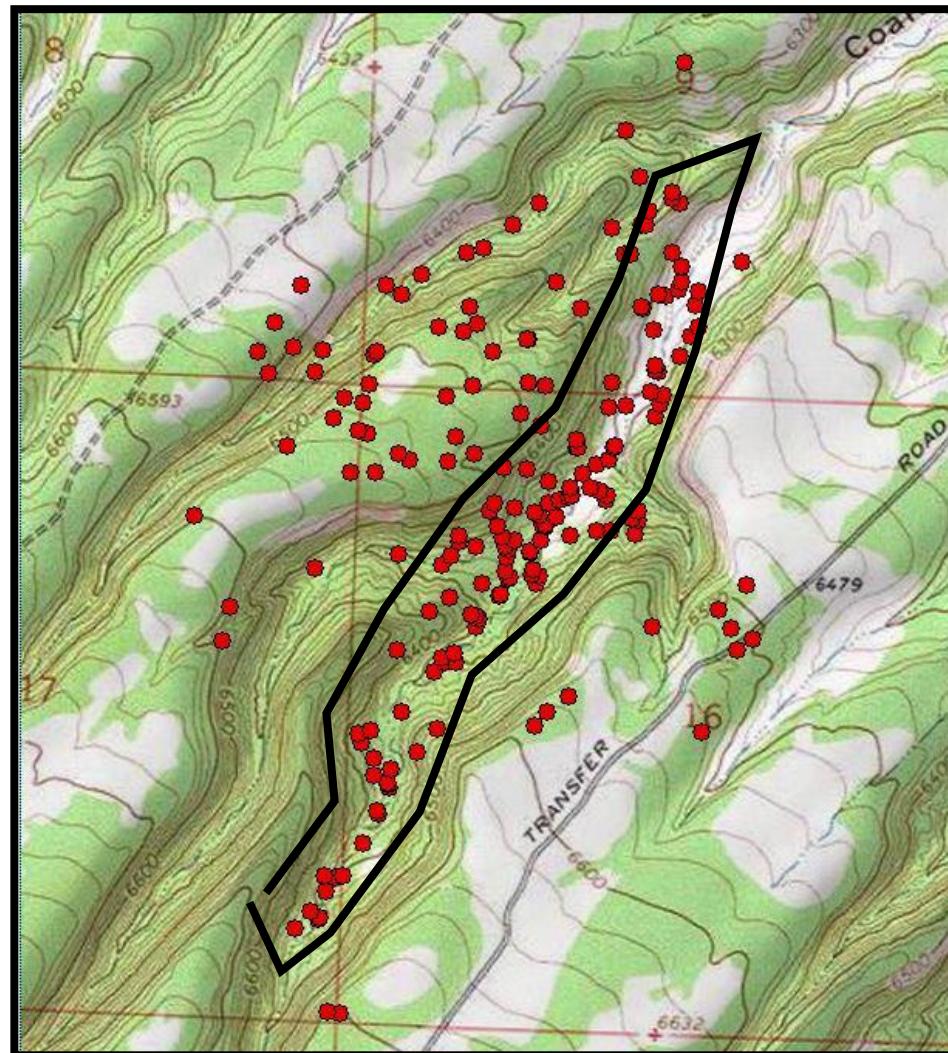
Breeding Habitat Sample Colony Sites

Transfer Road,
Montrose County



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Transfer Road, Montrose County

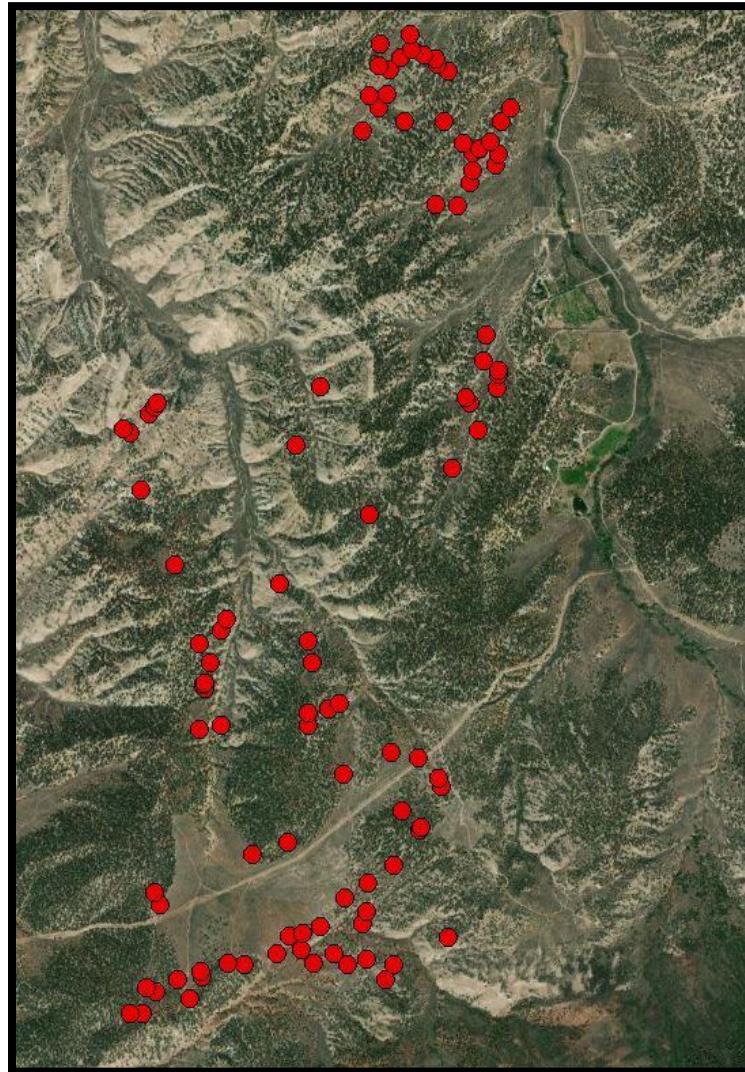
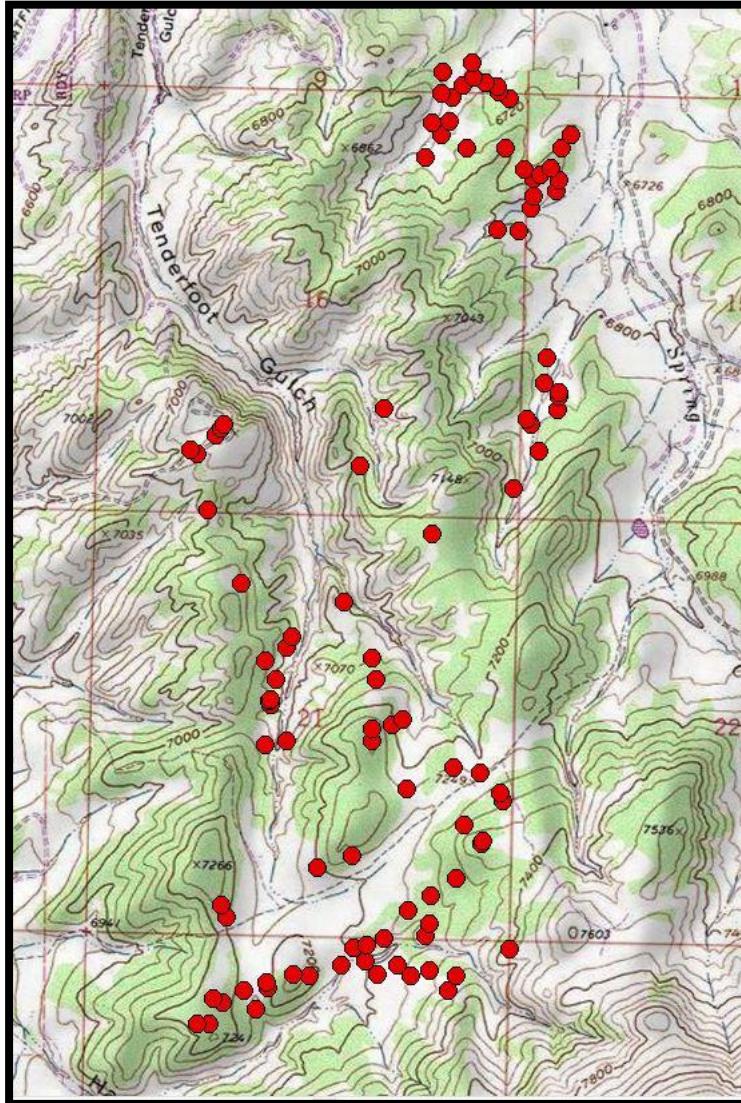


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Gypsum, Eagle County



Gypsum, Eagle County

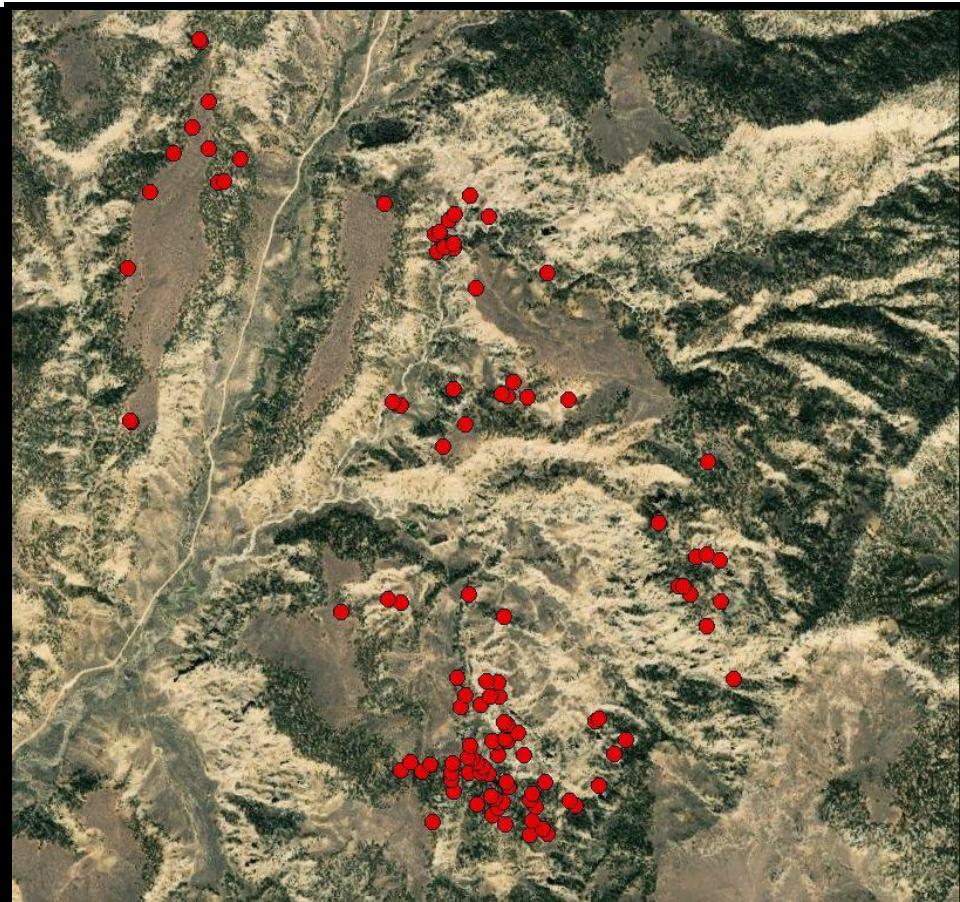
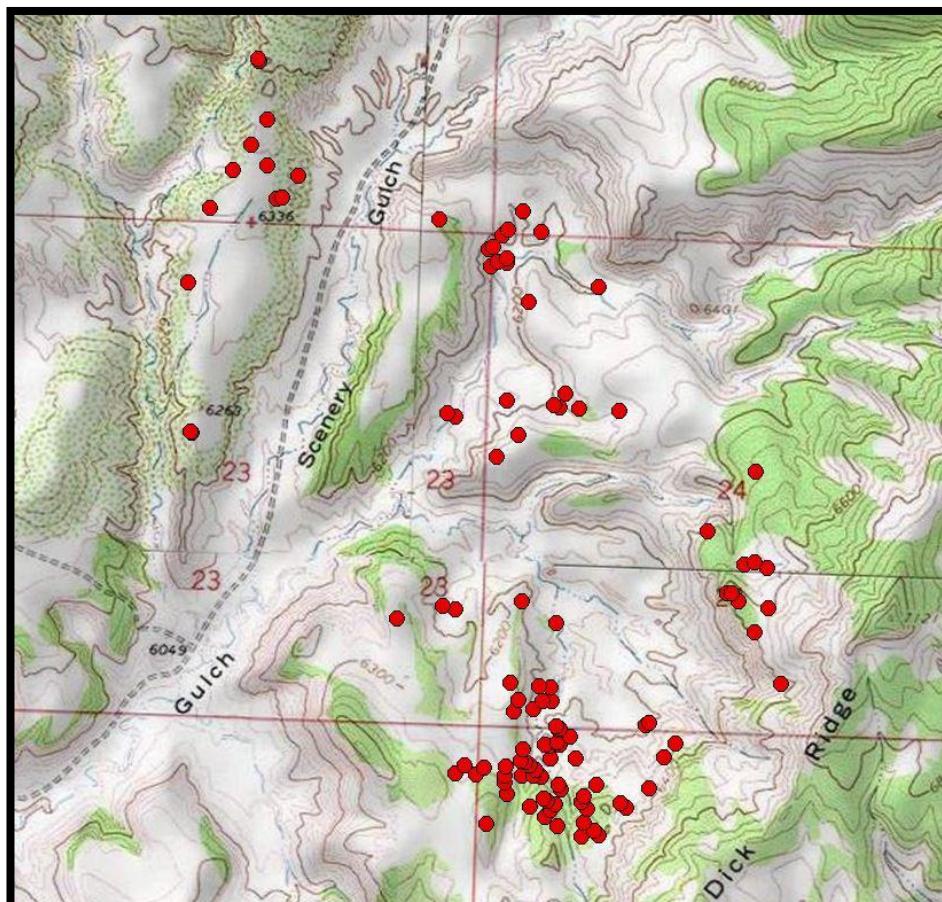


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Meeker, Rio Blanco County



Meeker, Rio Blanco County



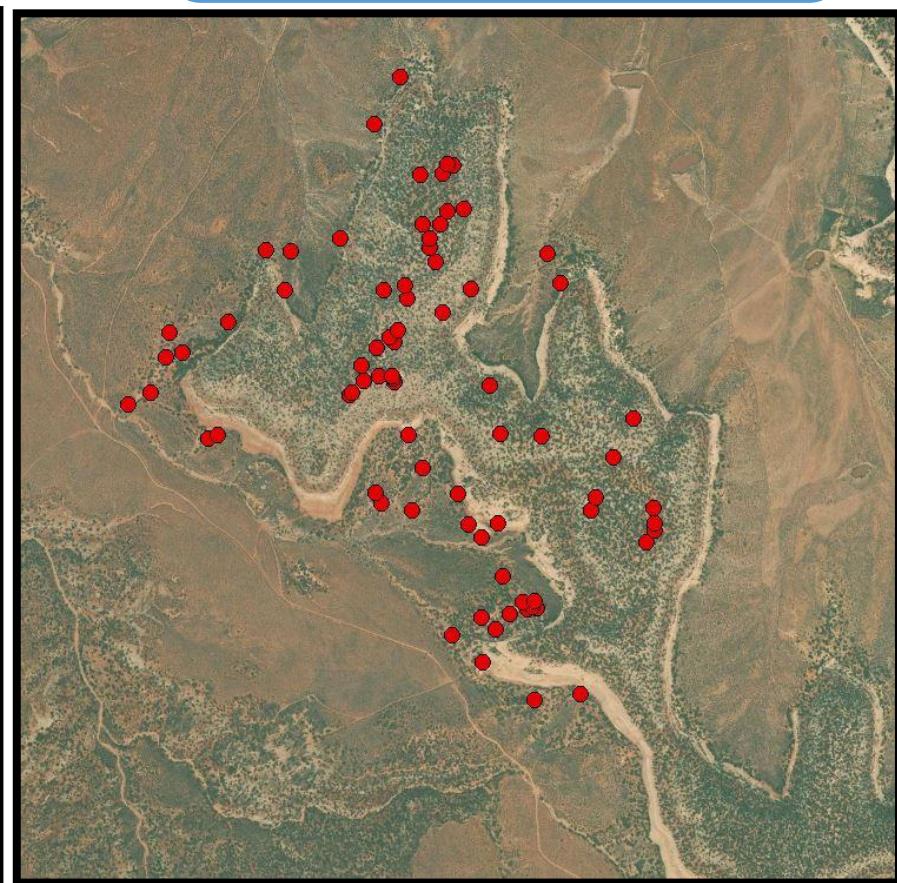
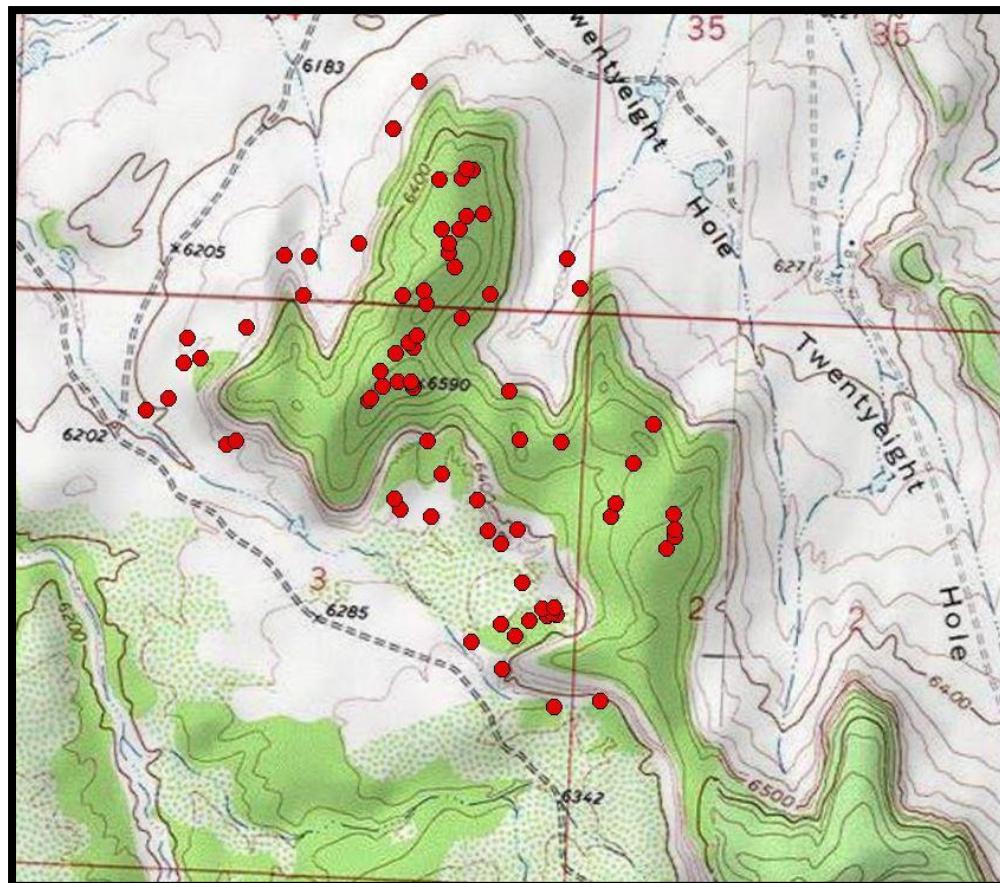
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Glade Park, Mesa County



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Glade Park, Mesa County



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San Luis Valley, Rio Grande County



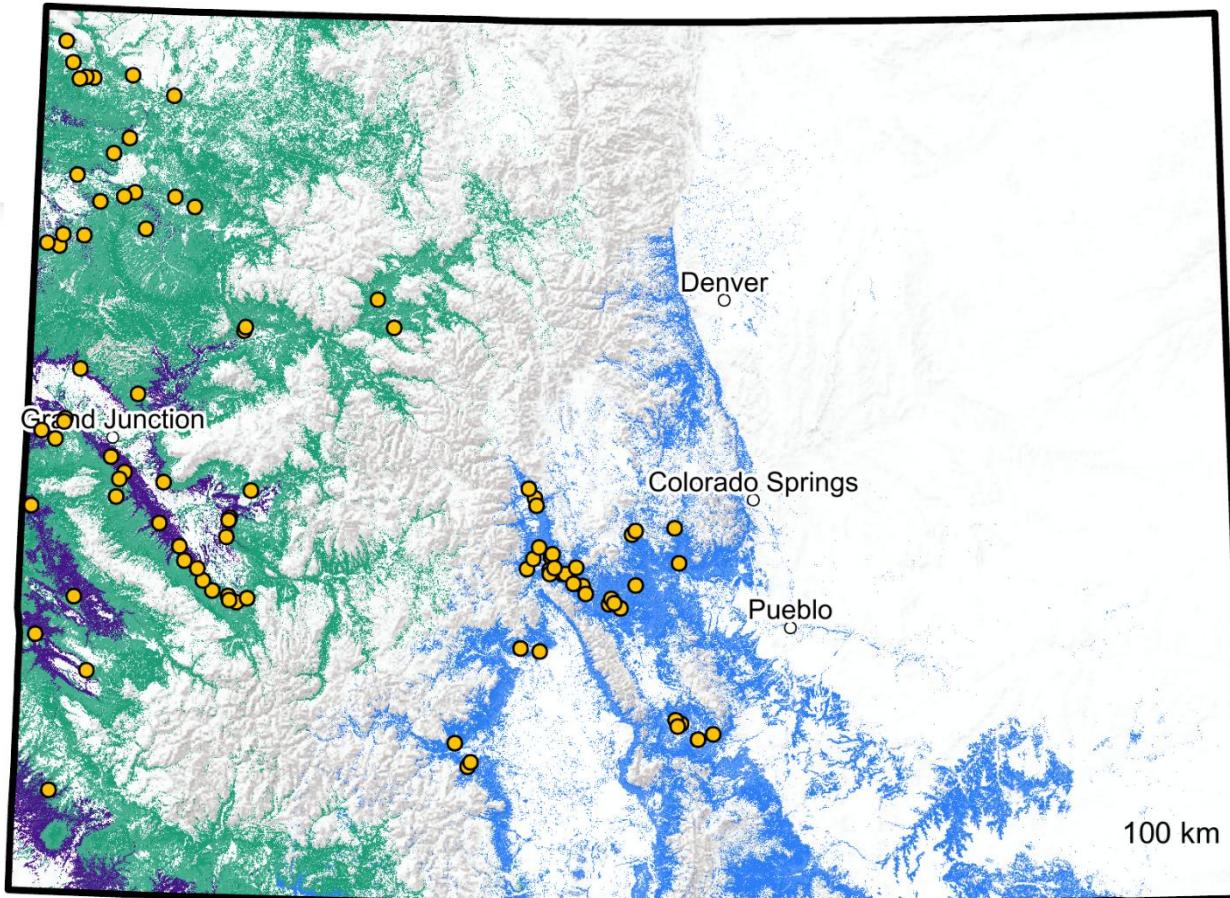
COLONY-SITE SUITABILITY MODEL

- Collaboration between CPW, BLM, and South Dakota State University
- Model is provided in both raster and vector formats
- Surveys should be conducted in **High Priority Conservation Areas**



Model Informed by Colonies

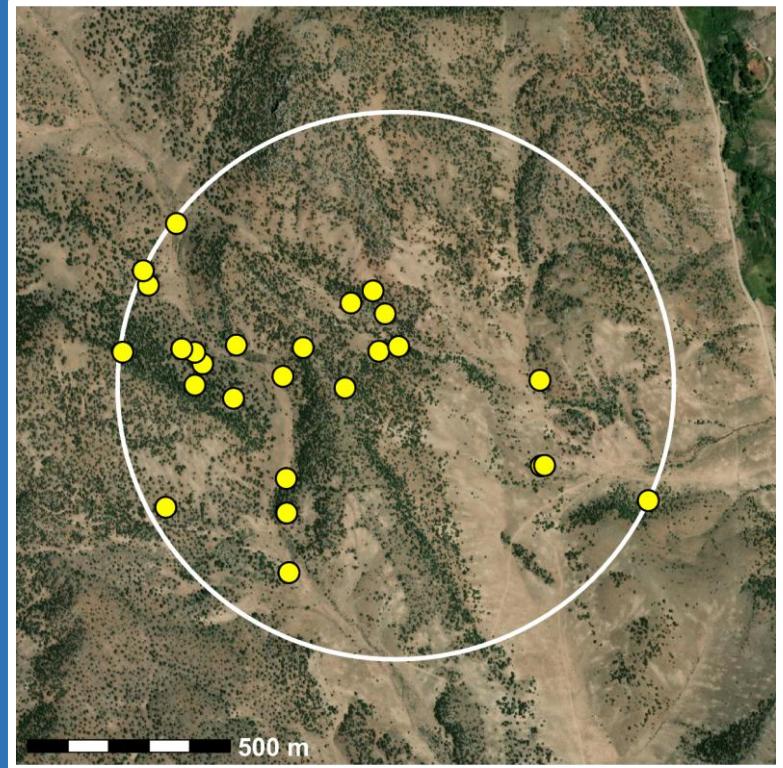
- Colony Site Definition
(for model)
 - Cluster of active nests within a given year
- 1-26 active nests per colony site
- Colony sites identified across Colorado: 2019-2024
 - 108 colony sites



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Defining Colony-Site Scale

- 22 colonies intensively studied in 2020-2021
- Minimum bound circle around nests of each colony site
 - Selected median circle
- Colony-site scale:
656 m radius (1.3 km diameter)
- Spatial rarefaction:
90 colony-site buffers
90 background buffers



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Model Design

- Random Forest Models

Breiman et al., 2024

- Cross Validation

Valavi et al., 2019

- 5 spatial blocked k-folds

- Variable Selection

Genuer et al., 2015

- 17 variables considered
 - 6 variables objectively selected to inform model



Slope



% Tree Cover



% Shrub Cover



Diversity of Tree Cover Classes
0 - 15%, 15 - 30%, > 30% tree cover



% Pinyon-Juniper Woodland



Precipitation of the Wettest Quarter



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Model Results

Accuracy	Kappa	Sensitivity	Specificity
88.33%	0.77	0.91	0.85

- Accuracy: 88% of colony-sites and background locations correctly classified by model

- Kappa: .077

< 0	0.21 – 0.40	0.41 – 0.60	0.61 – 0.80	0.81 – 1.00
Less than chance agreement	Fair agreement	Moderate agreement	Substantial agreement	Almost perfect agreement

- Sensitivity

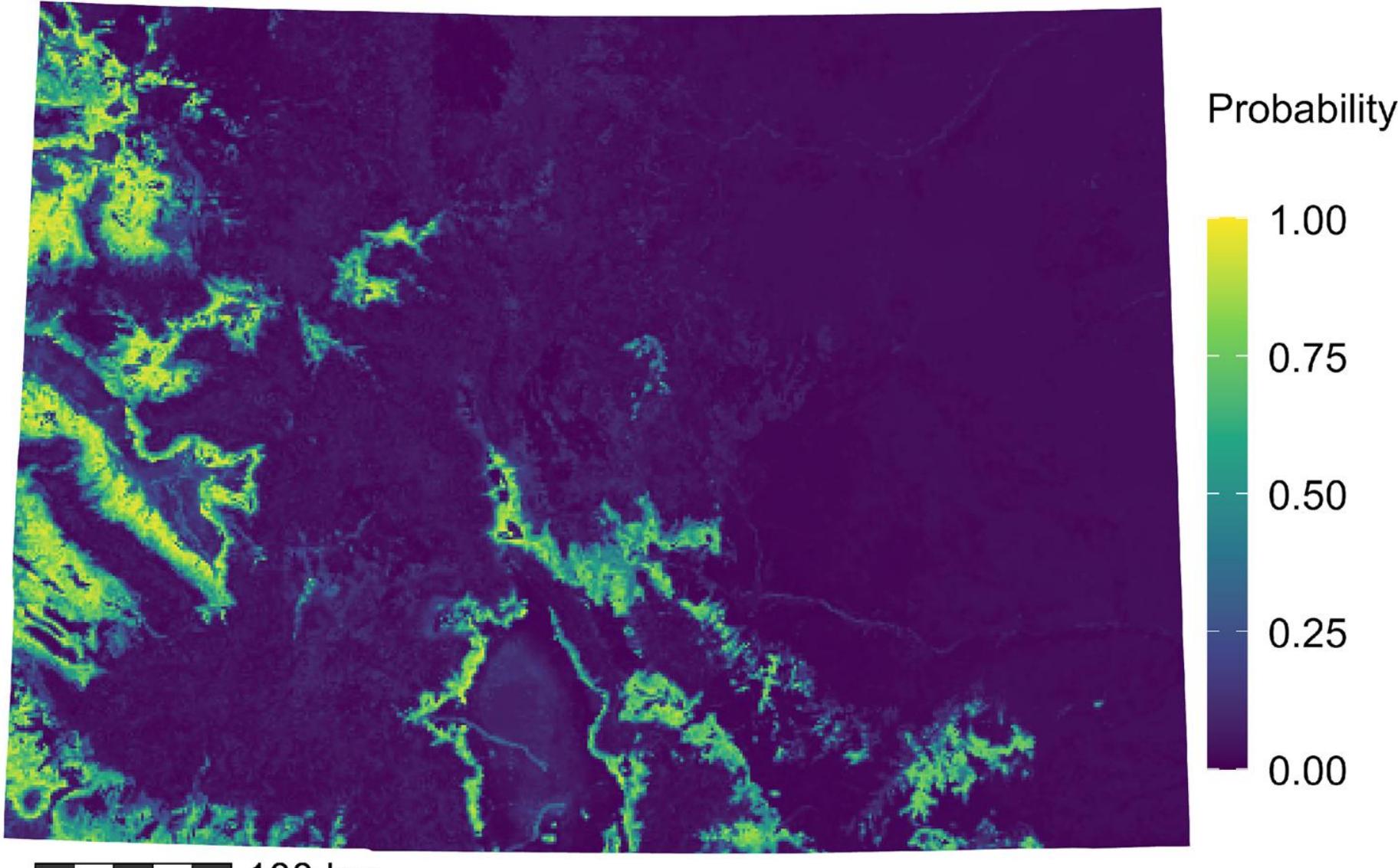
- True Positive Rate: 91% of colony sites correctly classified by the model

- Specificity

- True Negative Rate: 85% of background locations correctly classified by the model



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Suitability Model - Raster

Suitability Threshold

- maxSS criterion

Liu et al., 2019

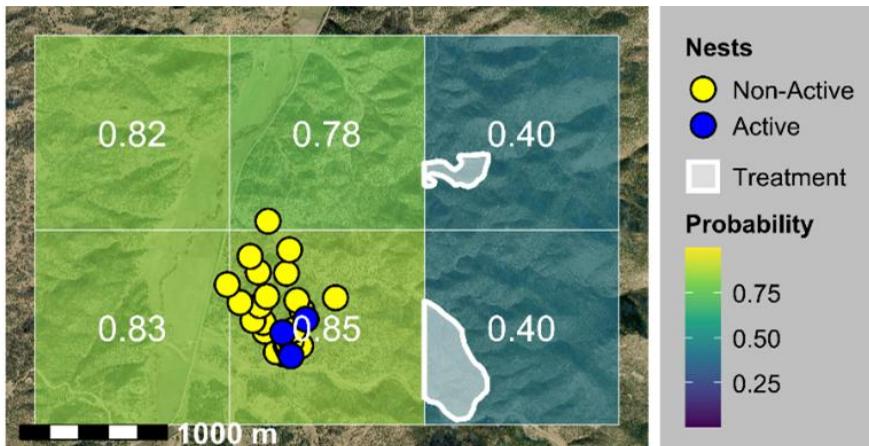
Maximizes the sensitivity and specificity

Accuracy	Kappa	Sensitivity	Specificity
88.33%	0.77	0.91	0.85

Threshold = 0.41 (41% probability of suitability)

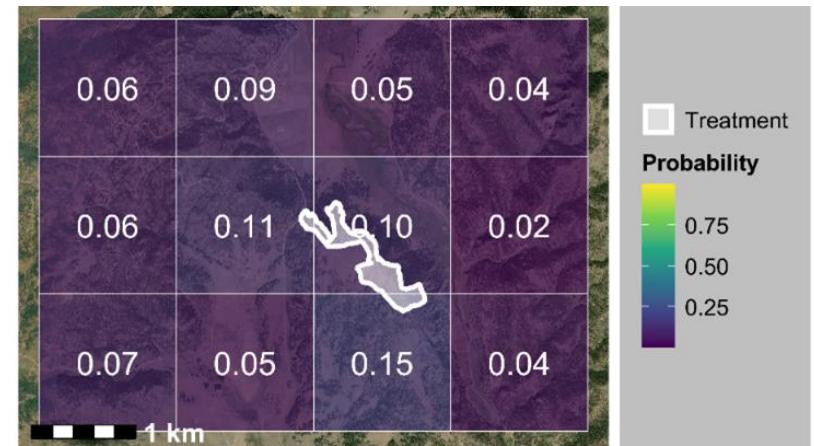
High suitability colony-site habitat

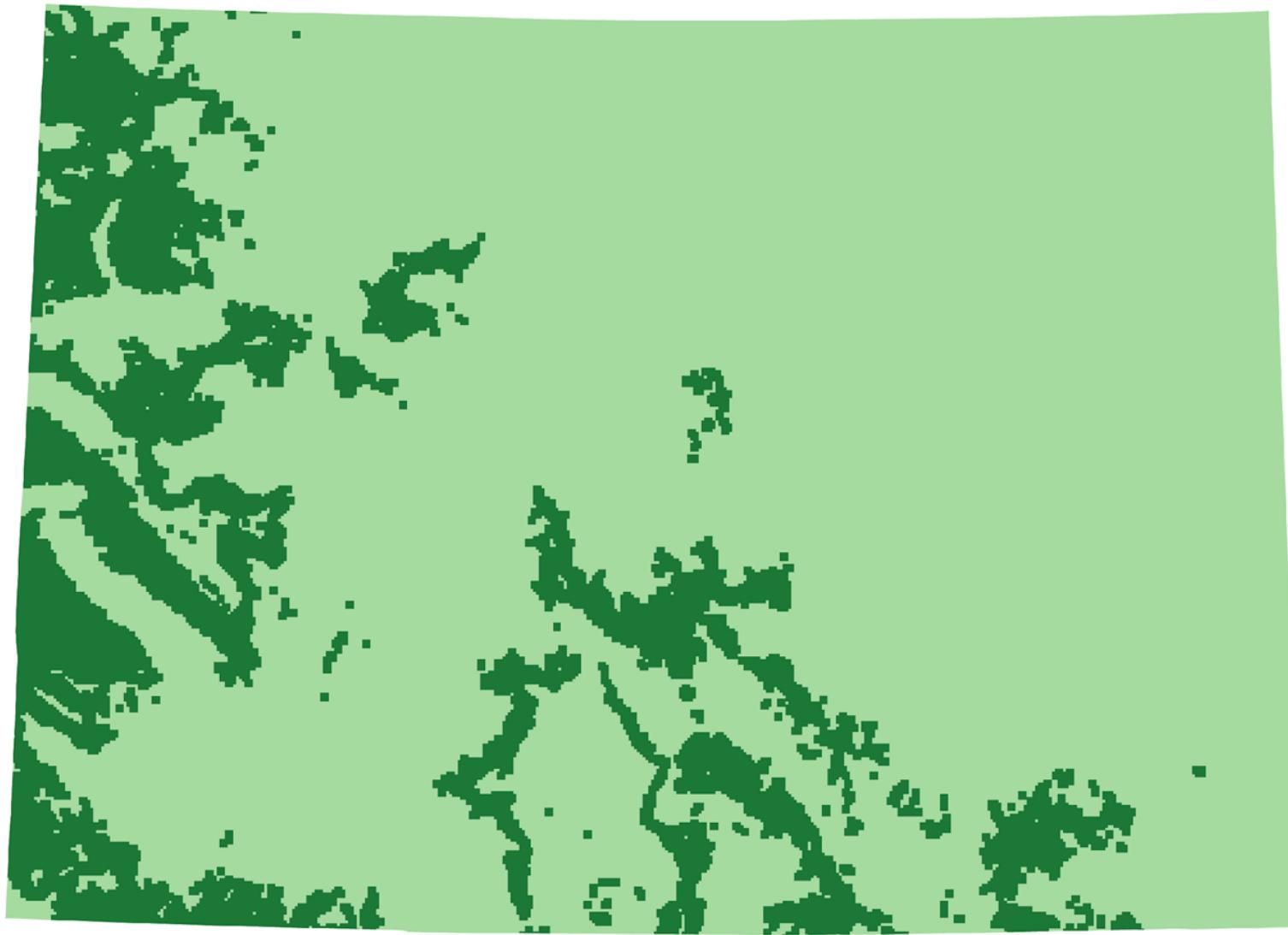
Cell ≥ 0.41 value



Low suitability colony-site habitat

Cell < 0.41 value





100 km

Priority Areas



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Suitability Model - Vector

Treatment Polygon

Low Priority Areas:

- Intersects raster cell(s) < 0.41 and is **not adjacent** to any cells ≥ 0.41
- Does not intersect with a vector **high priority area**
- No past evidence of breeding
- Lacking other evidence of suitable breeding habitat

- No timing limitations
- No pre-treatment surveys required, but encouraged in pinyon or juniper is present

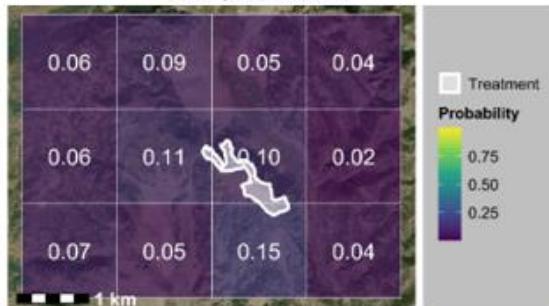
High Priority Areas:

- Intersects raster cell(s) ≥ 0.41 or is **adjacent** to any cells ≥ 0.41
- Intersects with a vector **high priority area**
- Intersects or is adjacent to raster cells or high priority vector areas with known colonies/nests determined from overlaying treatments on the colony/nest shapefile provided by CPW
- Identified to have breeding or evidence of suitable breeding habitat

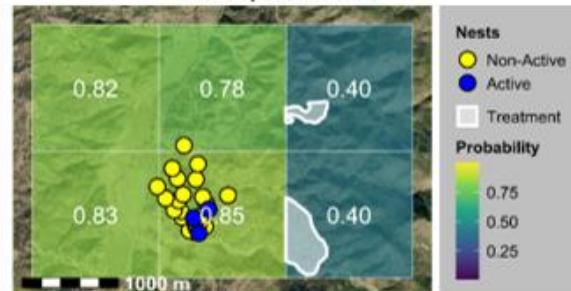
1. **Timing limitations** are highly recommended
 - Treatments $< 8,000$ ft: Feb. 15 – May 31
 - Treatments $\geq 8,000$ ft: Mar. 1 – May 31
2. **Pre-treatment surveys:** If timing limitations are not feasible, trained surveyors should conduct 3 pre-treatment surveys the spring prior to implementation following the CPW survey protocol to determine breeding activity
 - If no breeding activity is detected, timing limitations can be lifted

Follow treatment considerations for breeding pinyon jays regardless of detections or breeding activity

Example Scenario



Example Scenario



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Decision

Use Point Counts

- To determine if jays are active in an area 3 surveys are required to be completed every 7-10 days from late February to early April
- If no jays detected after 3 surveys - confidently say area is inactive
- If jays are detected begin colony survey



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Why Point Counts?

- Repeatable
- Unbiased
- Requires surveyors to stop and listen



Point Counts

- Start at sunrise to 30 minutes after
- 6-minute point count
- Data collection
 - Survey-level data
 - Date, wind, temp., cloud cover, precip.
 - Do not do point count in high winds, after significant snow or in heavy rain
 - Sighting-level data
 - # of birds observed
 - Method of observation (visual/aural)
 - Behaviors observed



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COLONY SURVEY METHODS

- Once birds are located during point counts, follow them to determine if they are breeding and where.



Mapping Colonies



- Colonies should be surveyed a minimum of 2x times throughout breeding season focusing on:
 - Early-season surveys
 - Document courtship behaviors
 - Locate pairs building nests
 - Mid-season surveys
 - Look for males feeding females
 - Pairs feeding nestlings
 - Late-season surveys
 - Look for young sentinel jays
 - Freshly fledged young sulk low in trees
 - Late or re-nesters



Early-Season Surveys

- Arrive 30 minutes before sunrise to setup observation point above colony (e.g., ridgeline) or point near the colony where birds can be observed, but little disturbance occurs.
- Watch and document breeding behaviors and vocalizations (we have a defined list).
- Use the Field Maps data form to location of breeding behaviors/nest building from a safe distance.
- Do not walk in the colony looking for nests. Early season can cause jays to abandon nests.

Breeding Behaviors

Pair Flying Together (PF) – If you observe a pair of birds separate from a flock and fly off together, you should try and follow them to observe courtship behavior or nest building.

Mobbing (MB) – If you are at the edge or in the colony and a group of birds surrounds you (or another potential predator) and starts to make raucous warning calls, this is called mobbing. You should try to vacate to a more distant location if this happens. Helpers can be very ready to mob a potential intruder early in the breeding season and when young are fledging.

Display Flights (DF). A small group of individuals fly rapidly through and above trees, emitting loud *Krawks* as they perform steep dives and sharp turns. These flights contain yearlings and adult jays and always seem to contain one or more leaders and a group of followers. Upon landing, individuals continue to chase each other up and down through the tree branches in sharp spiral patterns before initiating another flight.

Food Transfer (FT). This involves one bird holding a piece of food, offering it to its mate and the mate accepting it. This is usually a silent exchange, and you generally observe a pair off by themselves doing this courtship behavior.

Silent Sitting (SS). Pairs leave the foraging flock and fly to a perch, where they sit silently next to one another. While sitting near one another they may alternate raising their bill upwards displaying their white-throat bib.

Stick Manipulation (SM). A male picks up a stick, a twig, or tuft of grass and if the female does not respond, he drops the material. As courtship proceeds, stick manipulation increases in frequency and becomes suggestive of nest-building. You can hear pairs in trees making soft vocalization as they begin to select a nest tree to initiate nest building.

Nest Building (NB). Once a pair has selected a tree for nesting, they get to work. They both make numerous flights back and forth to collect sticks placing them in the nest tree. This is a great time to locate a nest from a distance because they make straight flights in and out of the nest tree.

Carrying Nest Lining (CNL) – Birds will collect fine, fluffy materials in their bill to line a nest. This indicates the nest is almost complete. It normally takes 5-7 days to complete a nest and for the female to start laying a clutch.

Courtship Begging (BG). Females crouch before their males with their heads slightly extended, open bills pointed slightly upward, with wings flapping or fluttering. The begging calls can be very insistent and loud. Females can be seen flying after males as they continue to beg. Female begging will sound the same as nestling and fledgling begging, but in the early season you can assume it is most likely a female begging to her mate.

Copulation (CP). Rarely seen. The birds stay low in the tree, and you can hear a variety of low vocalizations prior to copulation.



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Vocalizations

- https://www.allaboutbirds.org/guide/Pinyon_Jay/sounds
- 1st Kaw - Typical contact call
- 2nd Multiple Rack - Danger call
- 4th Trills - Usually between pairs
- 5th Pipping rattle - Agitated Female
- 6th Rattle - Agitated female
- 7th Begging - Can be a female or young



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Mid- to Late-Season Surveys

- Once breeding behavior activity declines and birds are predominantly incubating, observations of feeding bouts will be done from a safe distance to assess number of pairs and nest locations.
- **NEVER** actively move a female off of a nest or visit a nest if potential predators are noted in the area.



Fledglings

- Soon after fledging, family groups leave the colony area and disperse into the surrounding habitat.

- Unless fledglings are located near a nest tree, presence will not be recorded as being in a colony area.



Class 1 Nests

Map colony spatial structure,
size and movement using
locations of “OLD”, “ACTIVE”
and “NEW” nests



Class 2 Nests



Class 3 Nest



Class 4 Nest



Pinyon Jay Nests Transter Road Colony

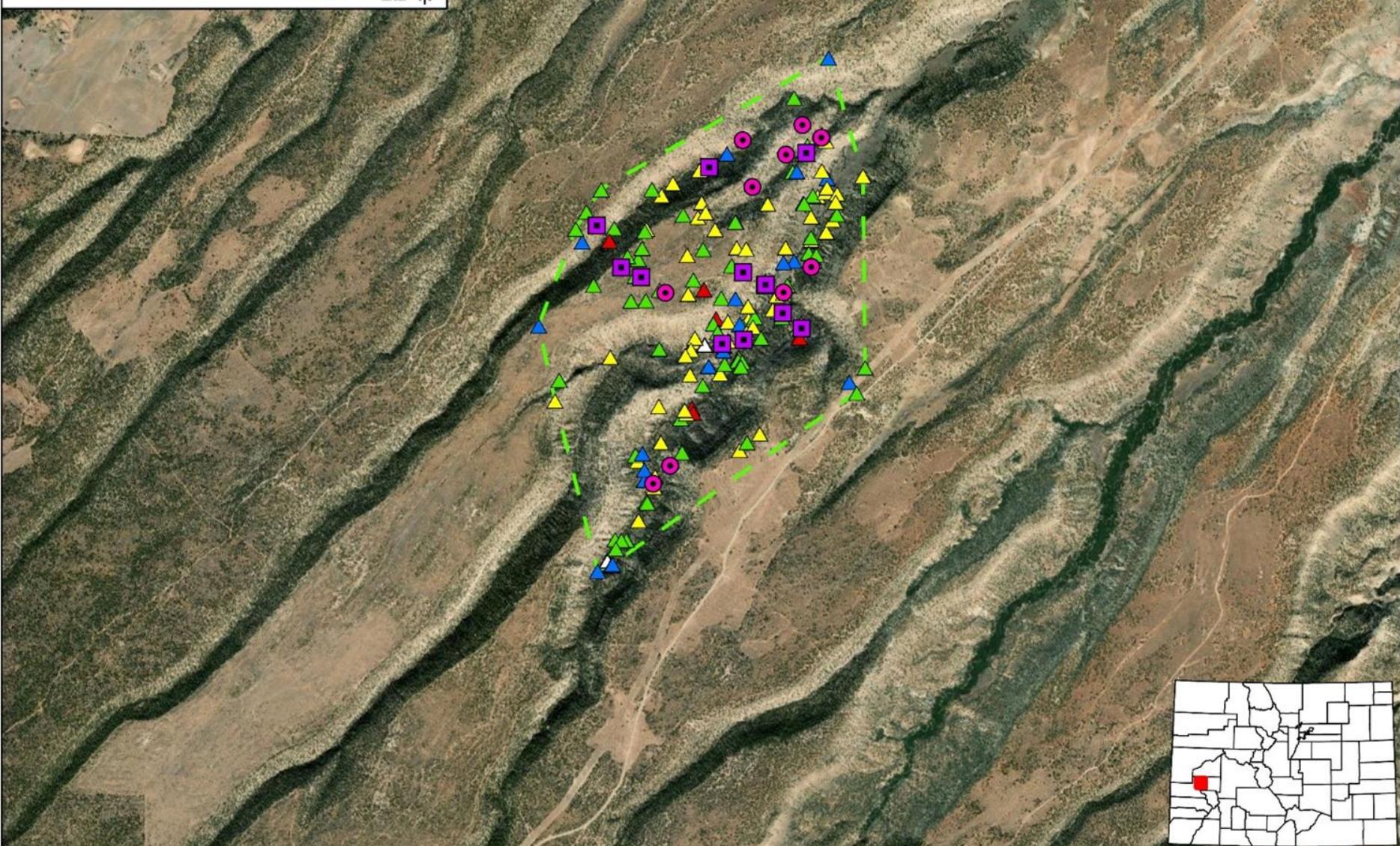
Located Nest Classification

- ▲ Nest Class 1 △ Nest Class Unknown
 - ▼ Nest Class 2 ● Active 2020
 - ▲ Nest Class 3 ■ Active 2021
 - ▲ Nest Class 4
- MCP Colony Boundary from All Nest Locations

0 150 300 600 900 1,200 Meters



N



Know your species



Woodhouse's scrub jay



Pinyon Jay



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A close-up photograph of a Pinyon Jay perched on a nest. The bird has a vibrant blue head and upperparts, with a white patch on its wing. It is surrounded by dry pine needles and twigs. The background is filled with out-of-focus green and yellow foliage.

Pinyon Jay



Woodhouse's scrub jay



Clark's nutcracker

Example of Nest Trees – Short Young Trees



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Young Healthy Trees



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Mature Old Trees



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Things to Consider

- Patience is key to mapping colonies.
- PIJA are extremely vigilant and have sentinels - surveyors must be quiet and sneaky.
- PIJA do have patterned breeding behaviors. These behaviors occur normally within colony boundaries.



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