CONDITIONED FOOD AVERSION WITH ODOR ASSOCIATION TO MITIGATE HUMAN-BEAR CONFLICT

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Photo courtesy of the WSU Bear Center

PROBLEM :

READILY AVAILABLE HUMAN SOURCES OF FOOD LEAD TO CONFLICT

- Bears take advantage of calorie-rich foods to prepare for hibernation.
- These foods ensure survival of the *threatened species* because females have cubs during hibernation

EXAMPLE PROBLEM AREAS:

- West Yellowstone recreational trails (2023)
- Flathead National Forest campgrounds (2023)
- Glacier National Park campgrounds (2023)
- Livestock in Bonners Ferry, ID (2022)
- Waste sites in Fremont & Teton County, ID (2022)
- Corn fields in Mission Valley, MT (2019)

Photos courtesy of East Idaho News and Minnesota Department of Natural Resources

PROBLEM : READILY AVAILABLE HUMAN SOURCES OF FOOD LEAD TO CONFLICT

- Property and resources lost annually → **ECONOMIC IMPACT**
- Repeat offenders are removed → **POPULATION IMPACT**

Farmer Greg Schock shows a clearing inside his cornfield made by grizzly bears in Mission Valley, MT, 2019. Fences were later built but were ineffective.

Photos courtesy of Minnesota Department of Natural Resources and Perry Backus

CONDITIONED FOOD AVERSION (CFA)

CONDITIONING:

- A single trial procedure where one learns to avoid foods that previously made them feel ill
- Pairing of food (Conditioned Stimulus; CS) with an agent causing illness (Unconditioned Stimulus; US) results in an aversion to that food (Conditioned Response; CR)
- Roots in classical conditioning with unique characteristics

USES AND BENEFITS:

- Can be used to shape behavior in wild animals
- Aversion can last long term; even a lifetime (theoretically)
  - Supported by pilot studies at WSU

Photo courtesy of Heather Havelock, WSU

CFA + ODOR (CFAO)

- **GOAL**: Associate odor with aversive effects
- Bears' reliability on their exceptional sense of smell may strengthen the aversion (2,100x better than a human's)
- **OUTCOME**: Once conditioned, the **odor itself** can become the deterrent


Photo courtesy of Chelsea Davis, WSU

- Past CFA studies
  - ✓ Jaguars (Cassaigne at al. 2023)
  - ✓ Black bears (Ternent and Garshelis 1999)
  - ✓ Grey Fox (Nielsen et al. 2015)
- **CFAO** studies have shown success in
  - ✓ Badgers (Baker et al. 2008)

GAP IN RESEARCH: GRIZZLY BEARS

PRELIMINARY STUDIES

WASHINGTON STATE UNIVERSITY

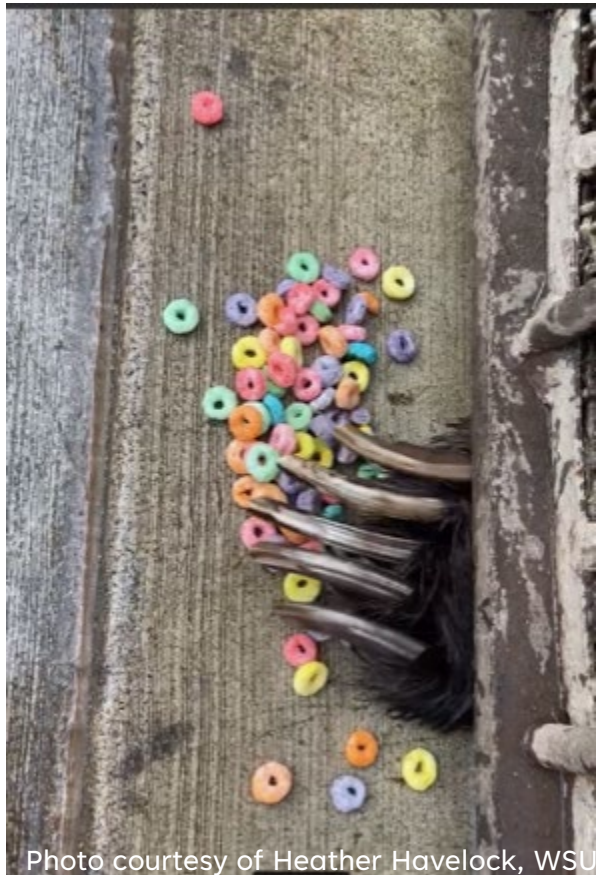


Photo courtesy of Heather Havelock, WSU

- Tested the effectiveness of CFAO with captive grizzly bears
- Thiabendazole (TBZ) used as aversive agent (US)
  - ➢ Tasteless odorless powder that induces sickness ‘feeling’
- Lemon oil used as odor cue
  - ➢ Neutral oil that isn’t likely found in bear habitat

PREDICTIONS:

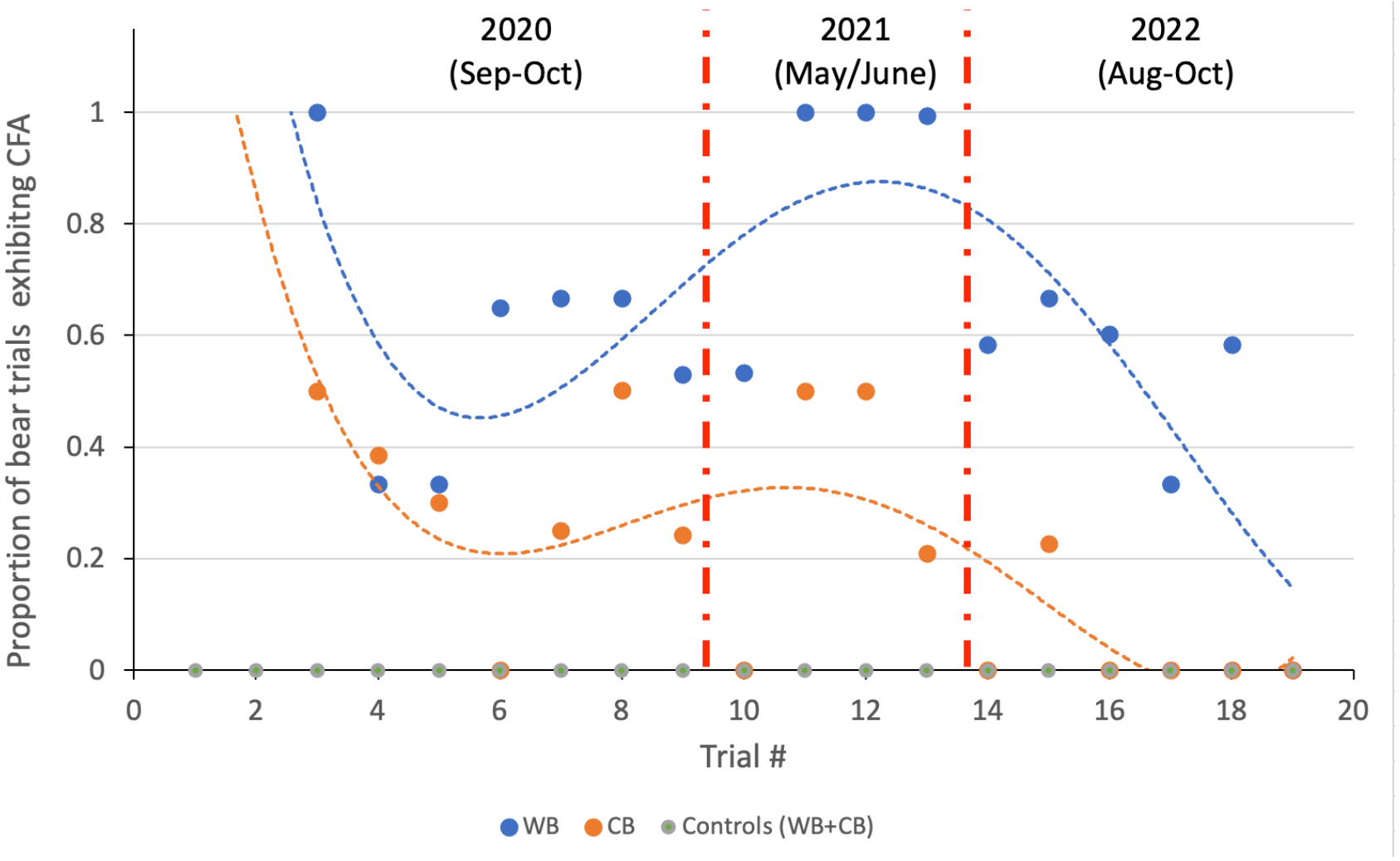
- ➢ Pairing US and an odor cue (CFAO) would enhance aversion to high-value foods
- ➢ CFA expression and persistence would be positively correlated to the amount of TBZ administered and/or the number of times a bear receives treatment

PRELIMINARY STUDIES

WASHINGTON STATE UNIVERSITY

RESULTS:

- Wild-born bears learned aversion quicker than captive-born bears.
- 5 out of 7 treated bears demonstrated CFAO after one year (after hibernation)
- 4 out of 7 demonstrated CFAO after two years
- Fall hyperphagia may weaken, but not eliminate, aversion



PRELIMINARY STUDIES

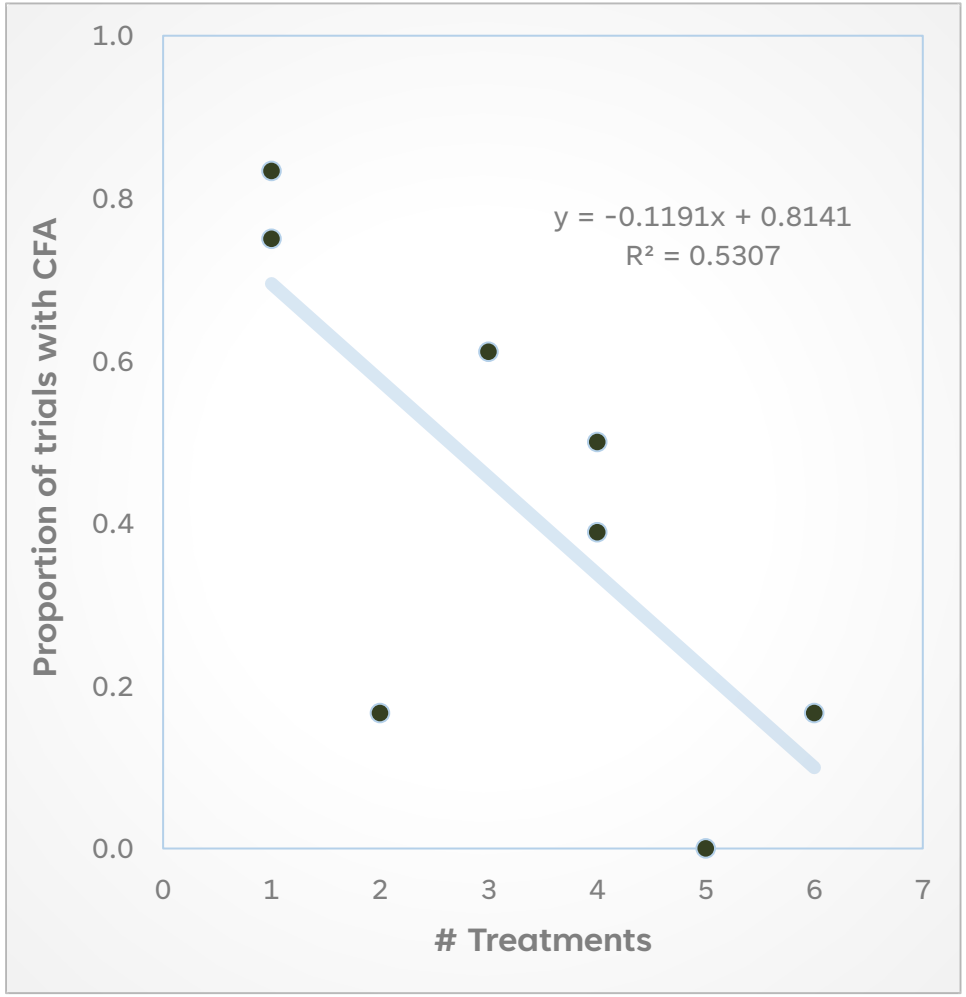
WASHINGTON STATE UNIVERSITY

RESULTS (CONT'D):

- Inverse relationship between the number of treatments administered and the proportion of trials bears that displayed a CFAO

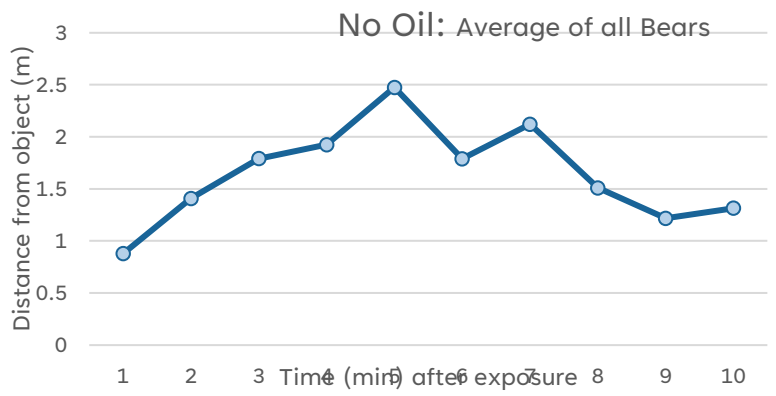
- Wild bears learned aversion with fewer treatments than captive-born bears.

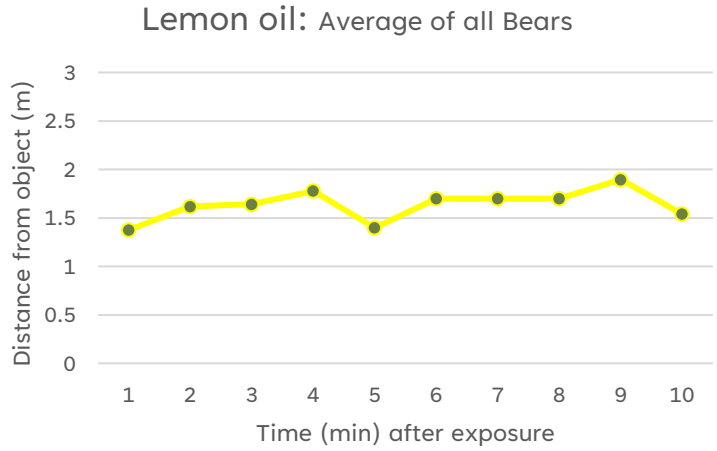
- CFAO achieved with fewer treatments showed stronger aversions

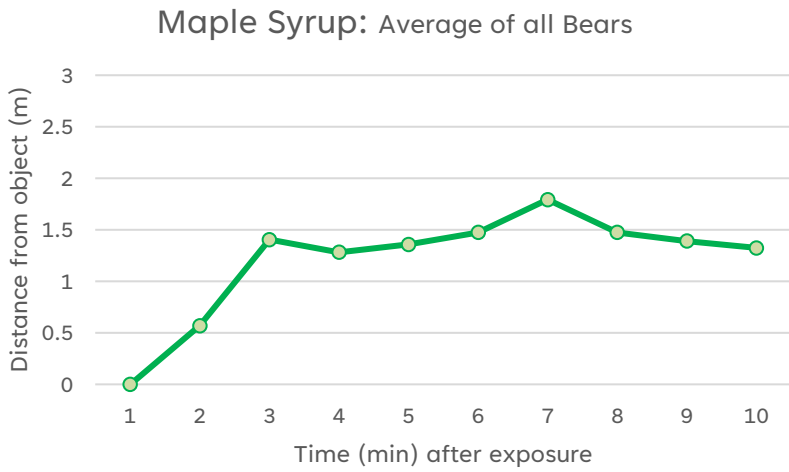


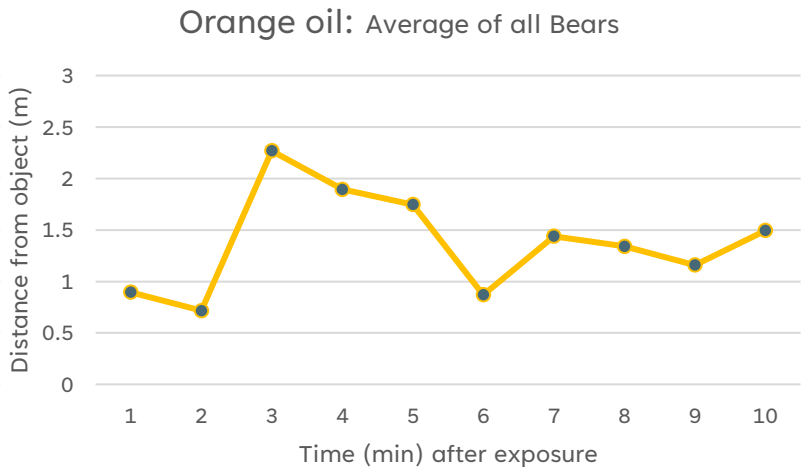
PRELIMINARY STUDIES

- WSU Bear Center bears (n=11) were exposed to objects sprayed with lemon oil and orange oil
- Behavior was observed to determine if these odors may serve as an attractant
- Is lemon or orange oil considered a relatively neutral oil to a bear?



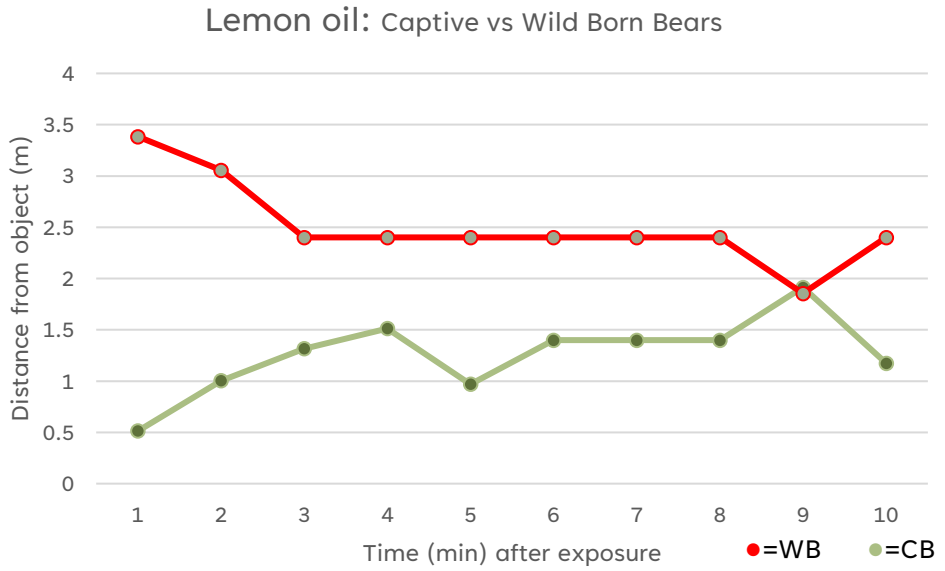


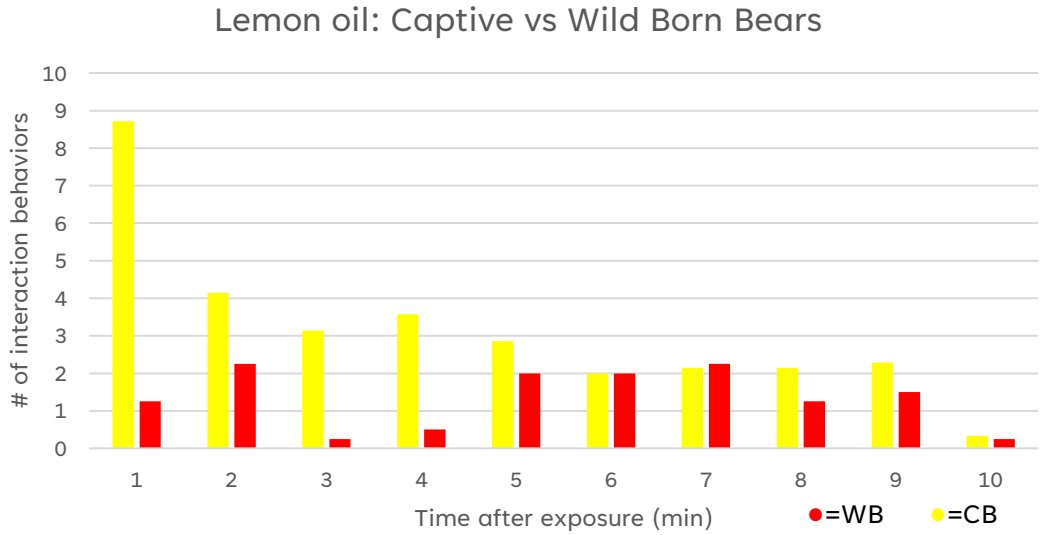




PRELIMINARY STUDIES

- Behavior was observed to determine if lemon oil remains a deterrent for experimental bears
- Wild born bears spent less time interacting with and near the odor than captive born bears





Questions before moving forward to field implementation?

OUTLINE OF PHASES

PHASE 1- CONDITIONING

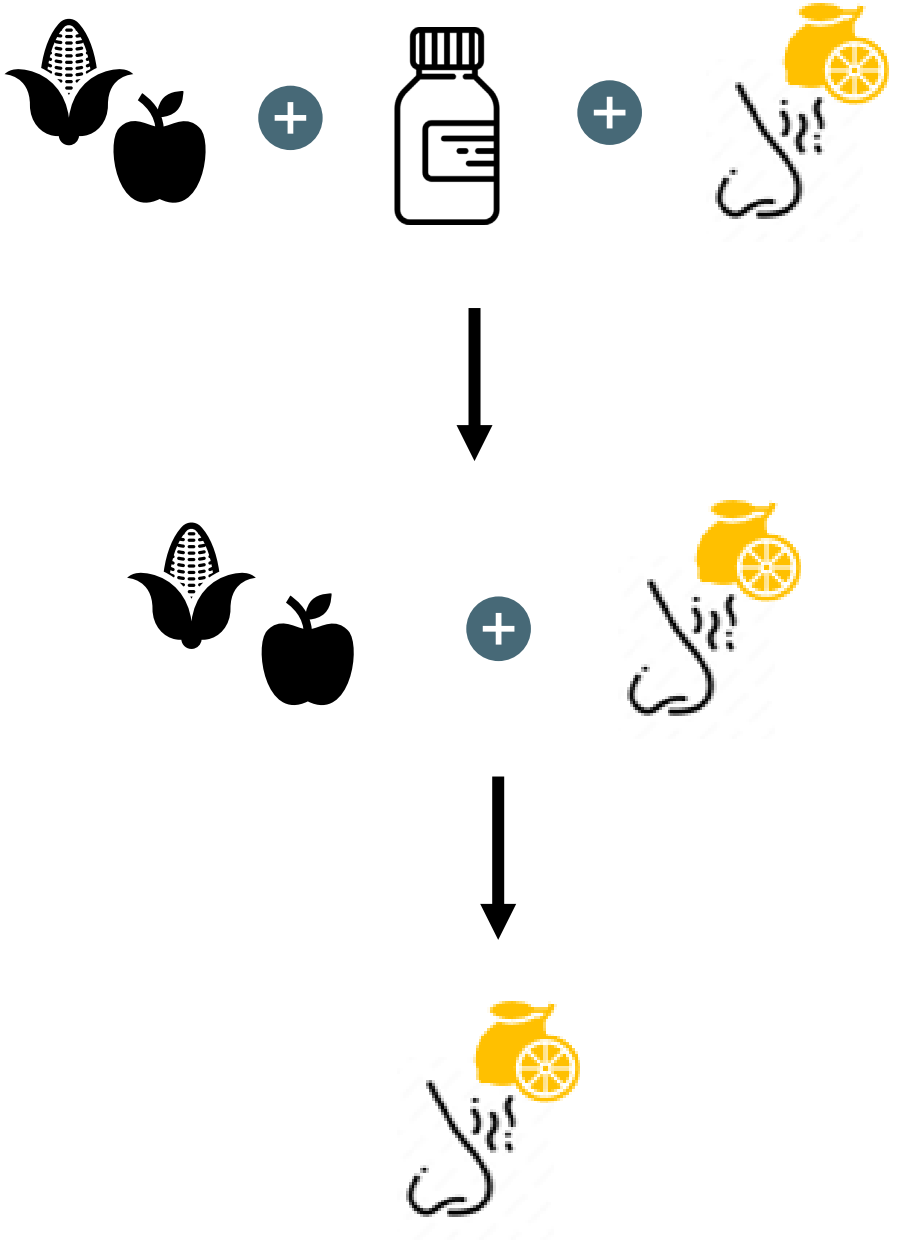
- Bears learn to avoid the food
- Only phase with TBZ
- Repeatable

PHASE 2- CONFIRM SUCCESSFUL CONDITIONING

- Return to phase one if needed
- Analyze trail cam behavioral footage and leftover food to measure success

PHASE 3- IMPLEMENTATION

- Implement odor only as a deterrent for conditioned bears



PROPOSED CFAO FIELD IMPLEMENTATION

1. CONDITIONING

- Testing stations with aversive agent and food plus odor
  - Stations located in drainages/corridors of natural travel away from the public
  - Leftover food will be measured and replenished as needed
  - Monitor visitors with trail cameras
    - Ideally 1-2 cameras per testing station

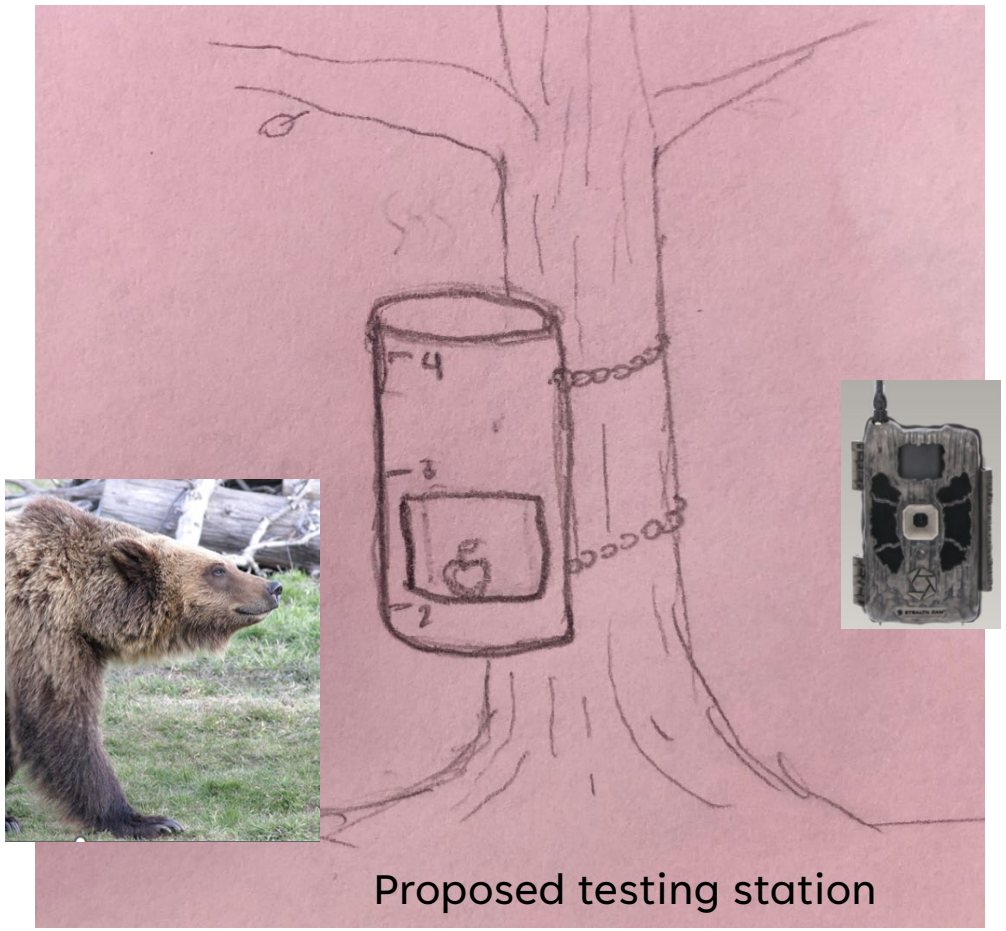

Photo courtesy of IDFV

AVERSIVE AGENT: MUST BE UNDETECTABLE WITH TEMPORARY EFFECTS

➢ Thiabendazole (TBZ)

- Tasteless odorless powder
- fungicide and parasiticide
- Short half-life
- Non-toxic to birds and mammals

PROPOSED CFAO FIELD IMPLEMENTATION



Proposed testing station

1. CONDITIONING- TESTING STATIONS

BARREL DRUM

- White drum for contrast
- Height markers to aid in identification

BOLTED/CHAINED TO TREE

- Height and access point reduces risk of other species accessibility
- Reduce risk of bear taking barrel

TRAIL CAM

- Cellular access
- HD video to analyze behavior
- Identify which bears are returning or new visitors

HIGH-VALUE FOOD

- Something that doesn't attract herbivores
- Not in bears' natural diet

2. POST-CONDITIONING

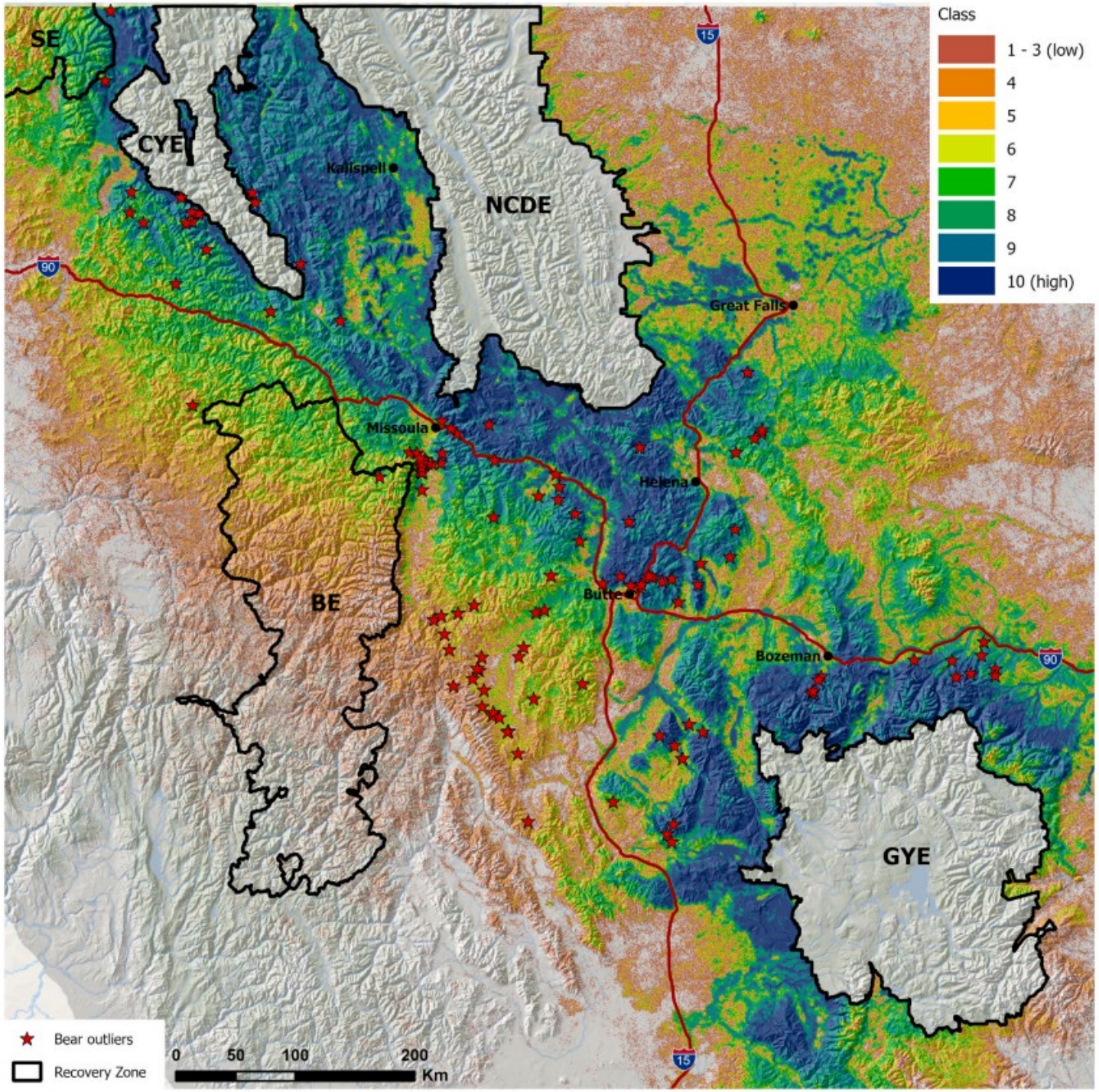
CFAO FIELD IMPLEMENTATION

- Testing stations with food and odor **only**
- Camera trap review of video to confirm conditioning was successful
- Camera trap review of video to confirm odor is an effective deterrent

3. APPLICATION

- Once conditioned, liquid odor **only** can be used as a bear deterrent
    - Lemon oil unharmful to crops and other species
- Treatments can be applied periodically to strengthen association and expose new bears

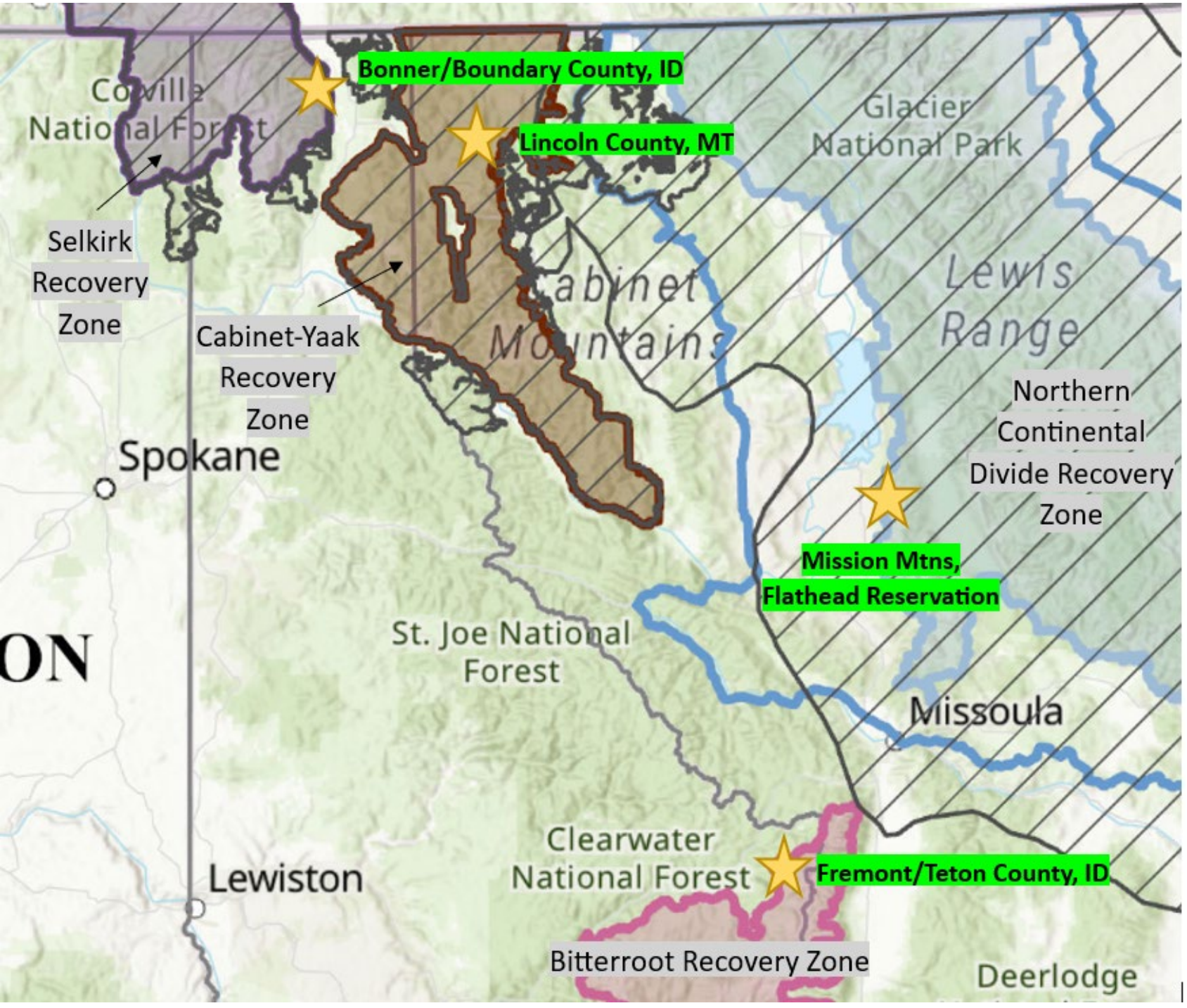
PROPOSED TESTING SITES



Predicted connectivity pathways between grizzly bear ecosystems in Western Montana **(SELLS ET AL. 2023)**

- Modeled movements to predict areas of connectivity
- Developed using data from 65 GPS-collared grizzly bears
- Directed and undirected paths
- Pathways were primarily associated with mountainous areas and secondarily with river and stream courses in open valleys

← This model is based off females taking undirected paths



PROPOSED TESTING SITES

Dependent on cellular tower coverage

Site ideals:

- 2 testing stations per site
- 1-2 trail cameras per station

Testing sites chosen in correspondence with Grizzly Bear Recovery Zones and conflict areas

- Assist in meeting GBRP objectives and targets for population sustainability and growth

PROPOSED TIMELINE OF FIELD STUDY

2024

SPRING

Order supplies
Build testing stations

EARLY SUMMER

(Phase 1)

Deploy camera traps
Deploy testing stations

MID-SUMMER

Review video
ID bears
Replace batteries

LATE SUMMER/ FALL

(Phase 2)

Re-deploy testing stations with oil only
Can re-deploy aversive if needed

MID-LATE FALL

Review video
ID bears
Replace batteries

THIABENDAZOLE- ENOUGH TO CONDITION 33 BEARS USING A SINGLE DOSE OF 150MG/KG OR ROUGHLY 16 BEARS AT 300MG/KG) $750

TRAIL CAMERAS - DECEPTOR NO-GLO CELLULAR TRAIL CAMERA $129.99
BEAR/ANTI-THEFT BOXES +$39.99
PYTHON CABLES +$19.99
CELLULAR PLAN MONTHLY CHARGE + ($8.00X 6 MONTHS = $48.00)
PREFERABLY 1-2 CAMERAS
X2
IDEALLY 4 SITES TOTAL X4
= $1,903.76

Budget estimate:

$3000-$3600

TESTING STATIONS– WE HAVE 55 GAL PLASTIC BARRELS AT OUR DISPOSAL. 55 GAL METAL DRUMS IF NEEDED COST $100-150 EACH X 4 BARRELS CHAINS OR STORE BOUGHT WOULD BE APPROX. $40. = $600

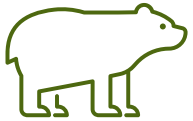
TRAVEL FROM PULLMAN TO REPLACE BATTERIES AND REPLENISH TESTING STATIONS. (5 TRIPS @ $75/TRIP [FOOD+GAS]) – NO LODGING = $300

BEAR SPRAY, INSECT REPELLENT – 2PK = $150

BENEFITS OF CFAO


Photo courtesy of the WSU Bear Center

Using a bear's ecological role and unique physiology to inform long-term management strategies instead of short-term, often inefficient, ones



Less expensive and less dangerous than other deterrents and lethal methods of control

Preserve human and natural resources to aid local communities and reduce risk of conflict

Contribute to conservation of a threatened species


QUESTIONS?

ADVICE WELCOME

LOCATION

- Drainages and corridors?
- Intercept normal travel
- Away from general public

LAND USE

- Permits?
- Permissions?

TESTING STATION

- Metal or plastic barrel?
  - Plastic is easier to carry in and out of hard-to-reach locations
  - Metal enforces bear resistance
- Input on high-value food
  - Something that can keep outside for a length of time