Conservation Dogs in Invasive Species Management: Contributions across taxa and spanning the invasion curve.

Pete Coppolillo, Ph.D. (he/him)
Executive Director, WD4C
Pete@WD4C.org
+1 (406) 290-9453

Aimee Hurt
Director of Special Projects, WD4C
Aimee@WD4C
+1 (406) 5291943

Working Dogs for Conservation

OPMC
Ontario Pest Management Conference
7 Nov,2024

ABOUT WD4C:

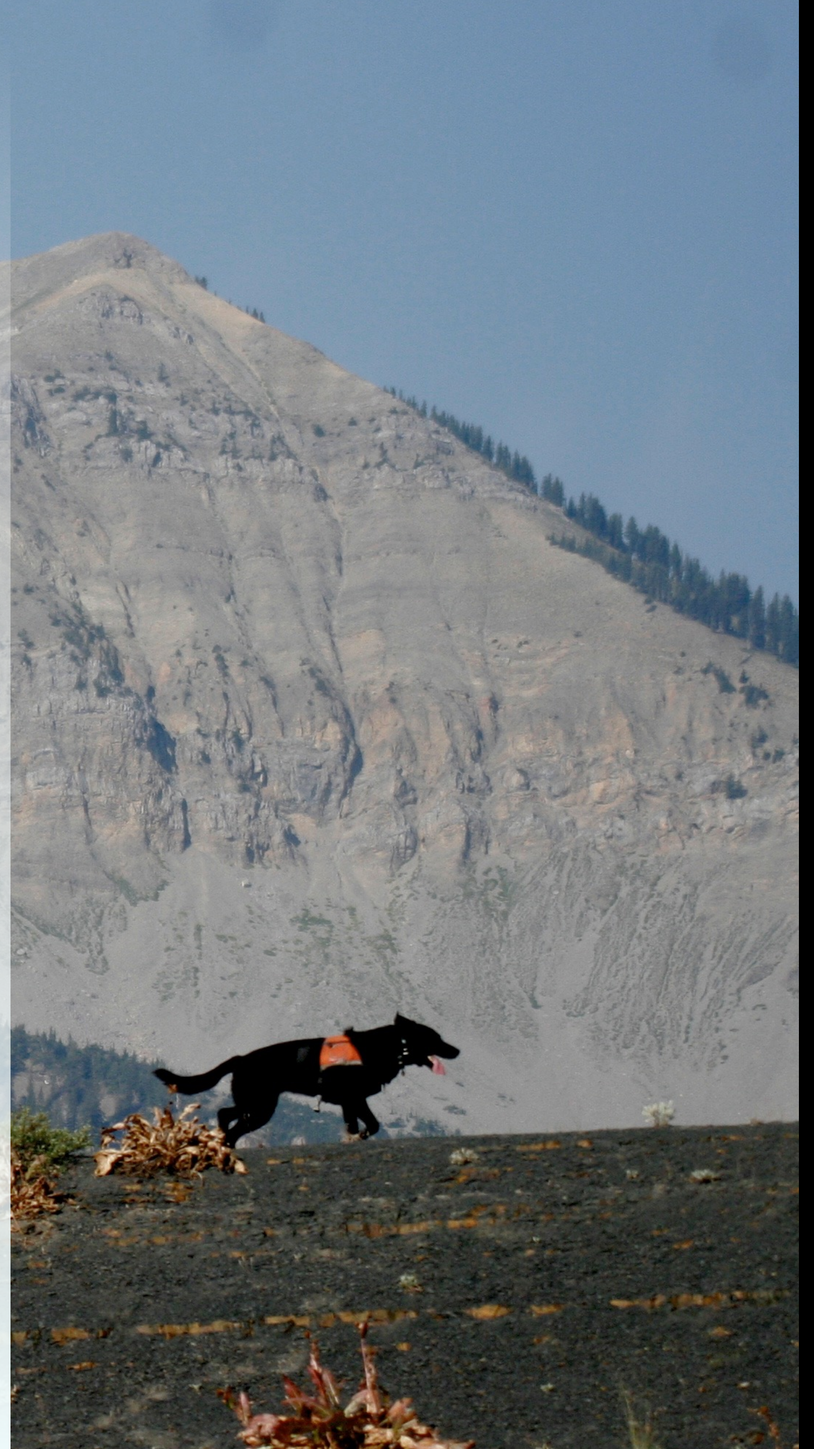
29th Year of Operations

Current Pack 98 Dogs
19 Full Time Staff

24 Countries, 32 US States

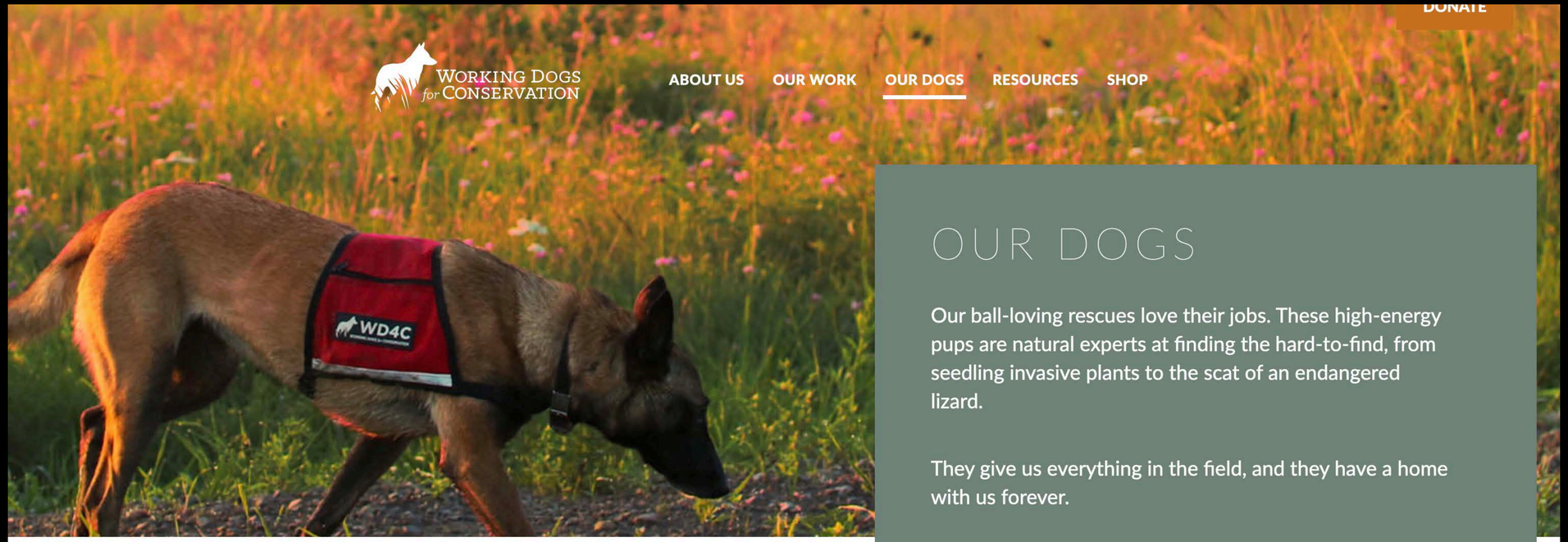
Consulting
Project Fieldwork
Capacity Building

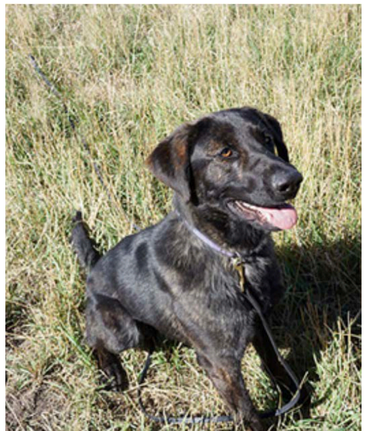
Ecological Monitoring,
Law Enforcement, Biosecurity,
Environmental Justice

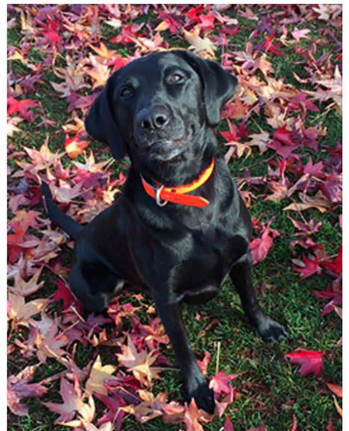


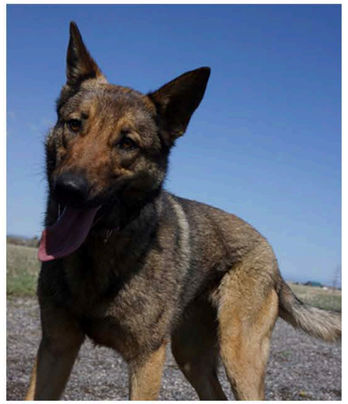
WD4C is Open Source

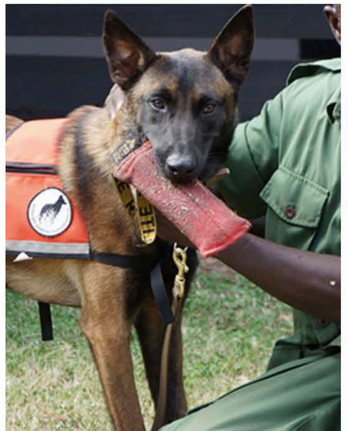
Rescue and Career Change Dogs











ABOUT WD4C:

29th Year of Operations

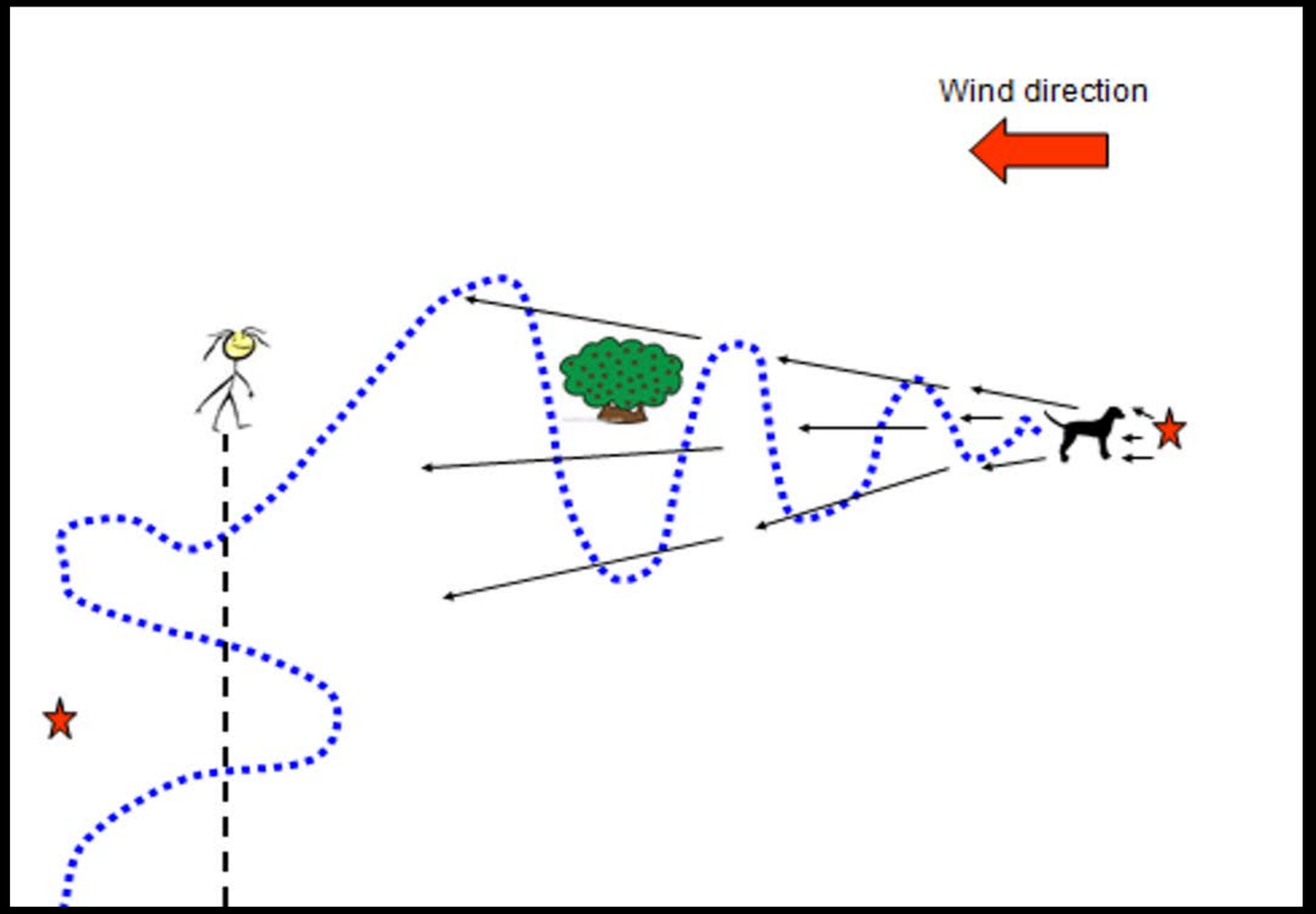
Current Pack 98 Dogs
19 Full Time Staff

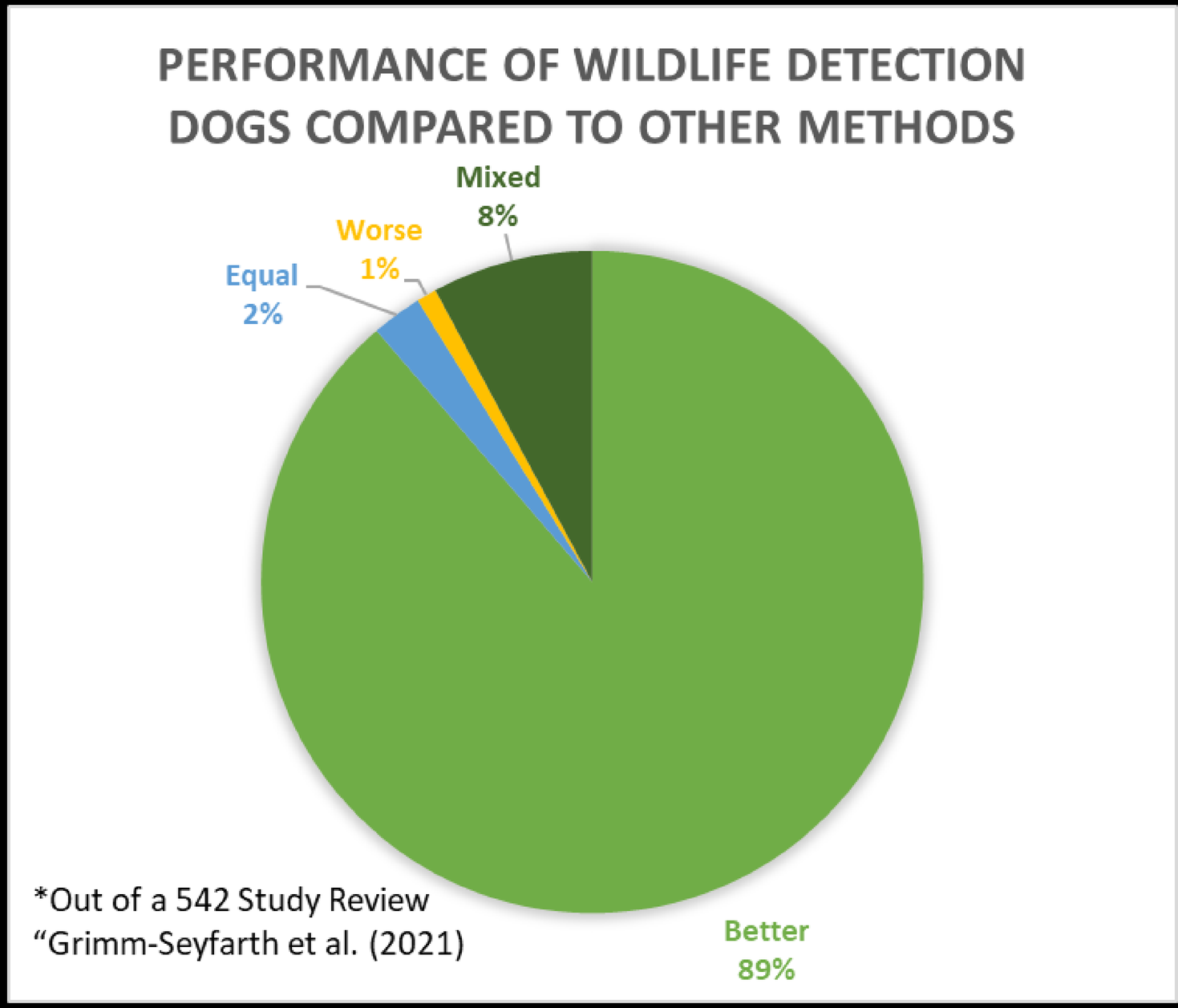
24 Countries, 32 US States

Consulting
Project Fieldwork
Capacity Building

Ecological Monitoring,
Law Enforcement, Biosecurity,
Environmental Justice

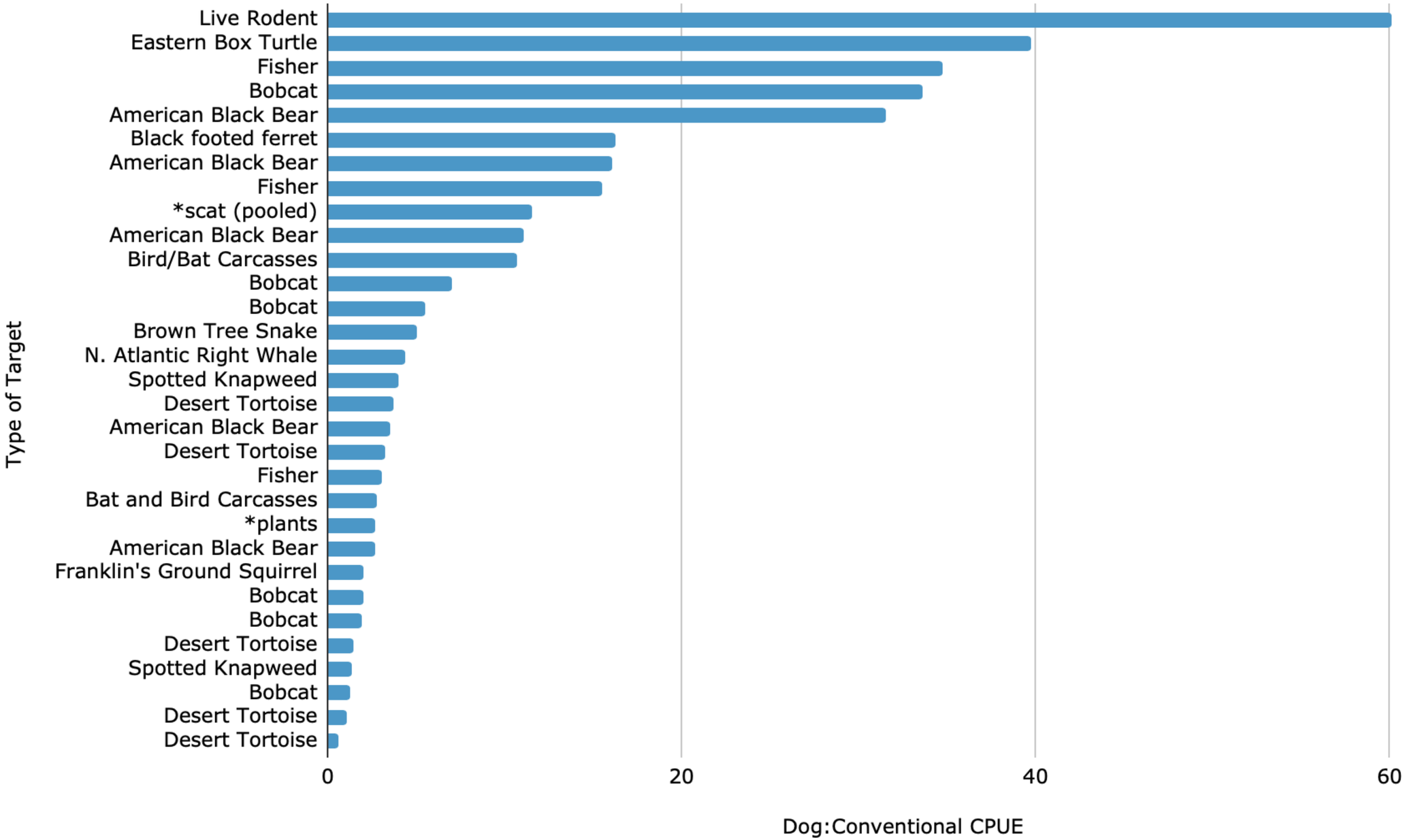
clockwise from top: wolverine, snow leopard, lynx


Wind direction

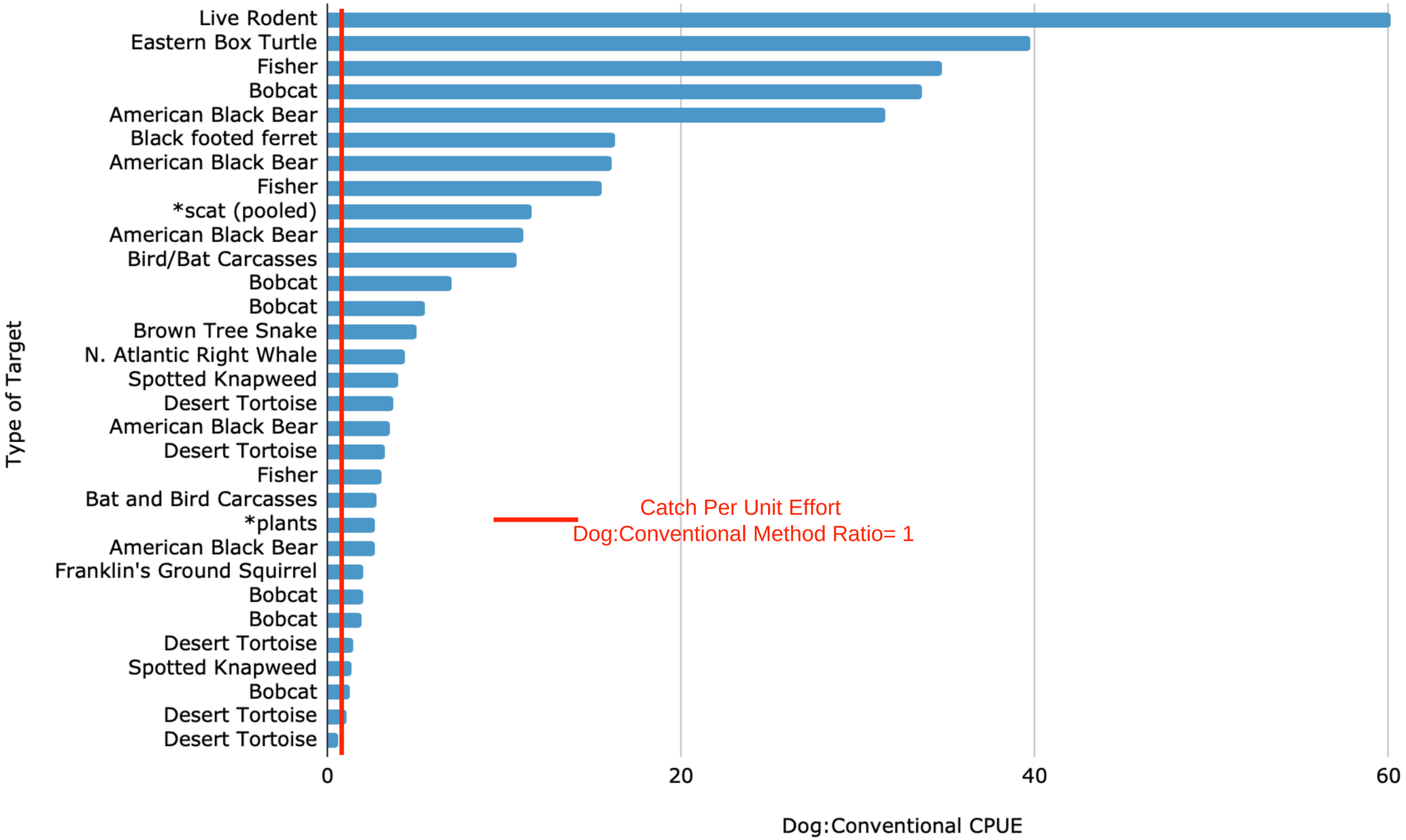


Grimm-Seyfarth, Annegret, Wiebke Harms, and Anne Berger. 2021. “Detection Dogs in Nature Conservation: A Database on Their World-wide Deployment with a Review on Breeds Used and Their Performance Compared to Other Methods.” Edited by Diana Fisher. Methods in Ecology and Evolution 12 (4): 568–79. https://doi.org/10.1111/2041-210X.13560.

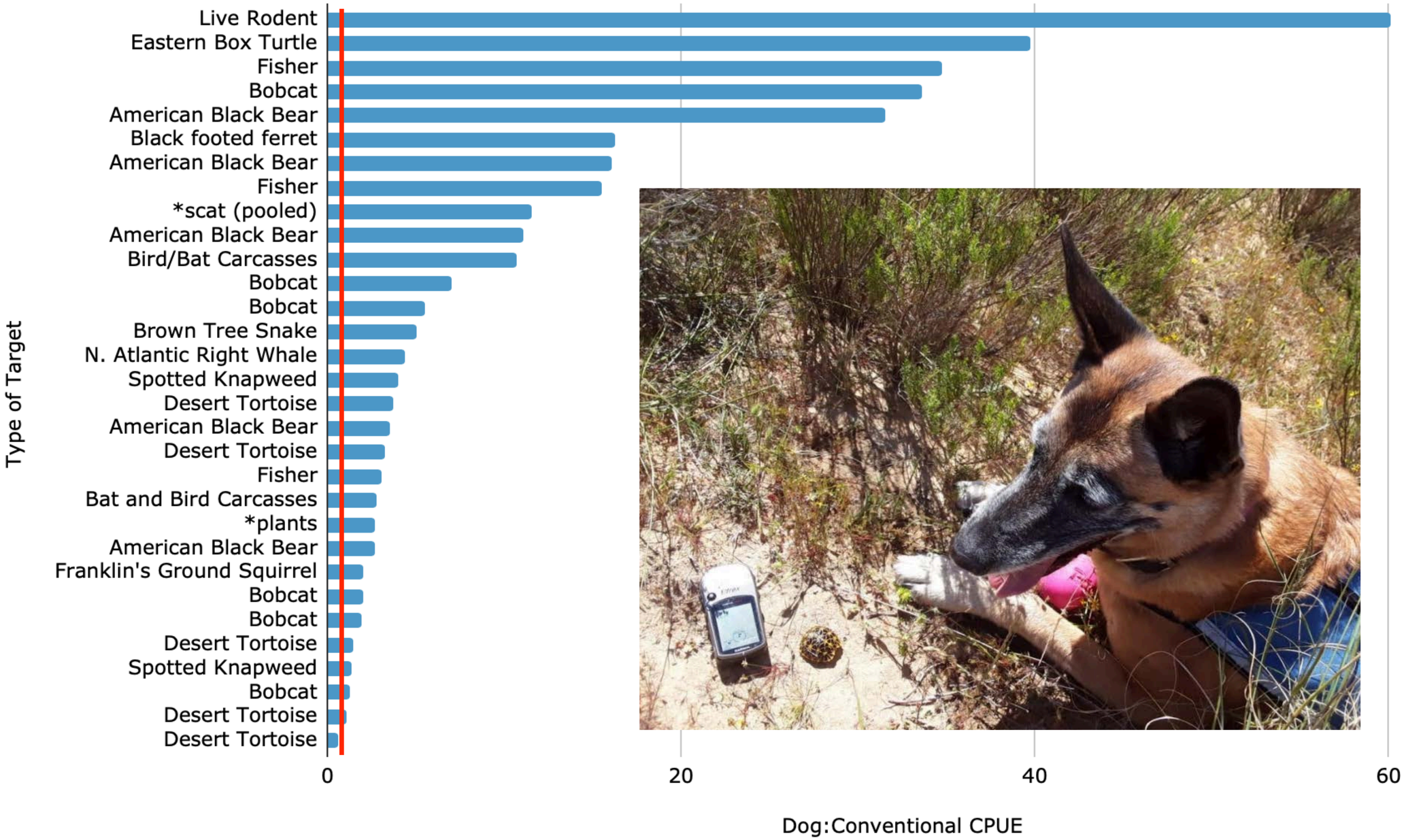
Dog:Conventional CPUE vs. Type of Target

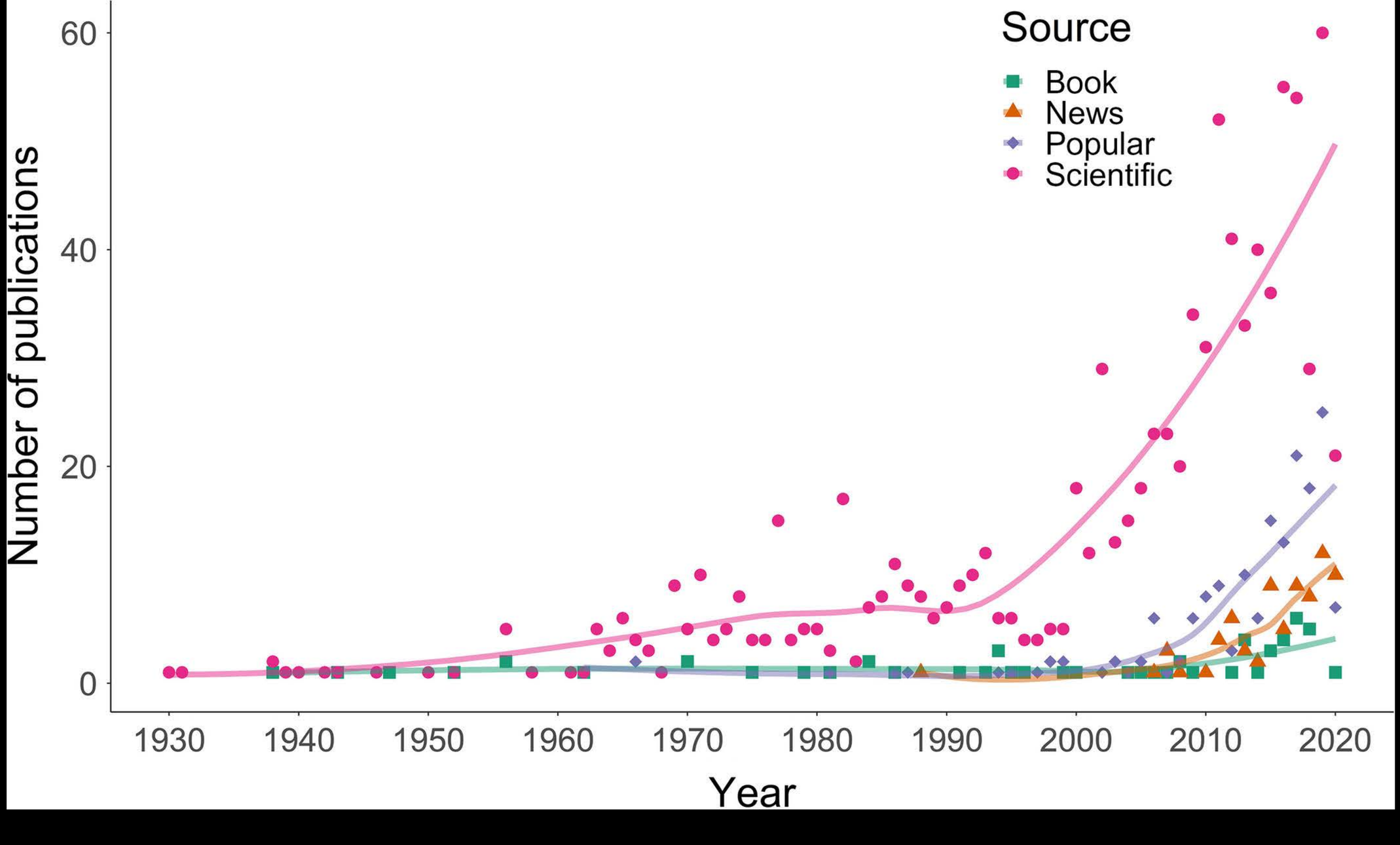


Dog:Conventional CPUE vs. Type of Target



Dog:Conventional CPUE vs. Type of Target





ature Conservation: A Database on Their World-wide Deployment with a Review on Breeds Used and Their Performance Compared to Other Methods." Edited by Diana Fisher. Metho

Biosecurity and Invasive Species

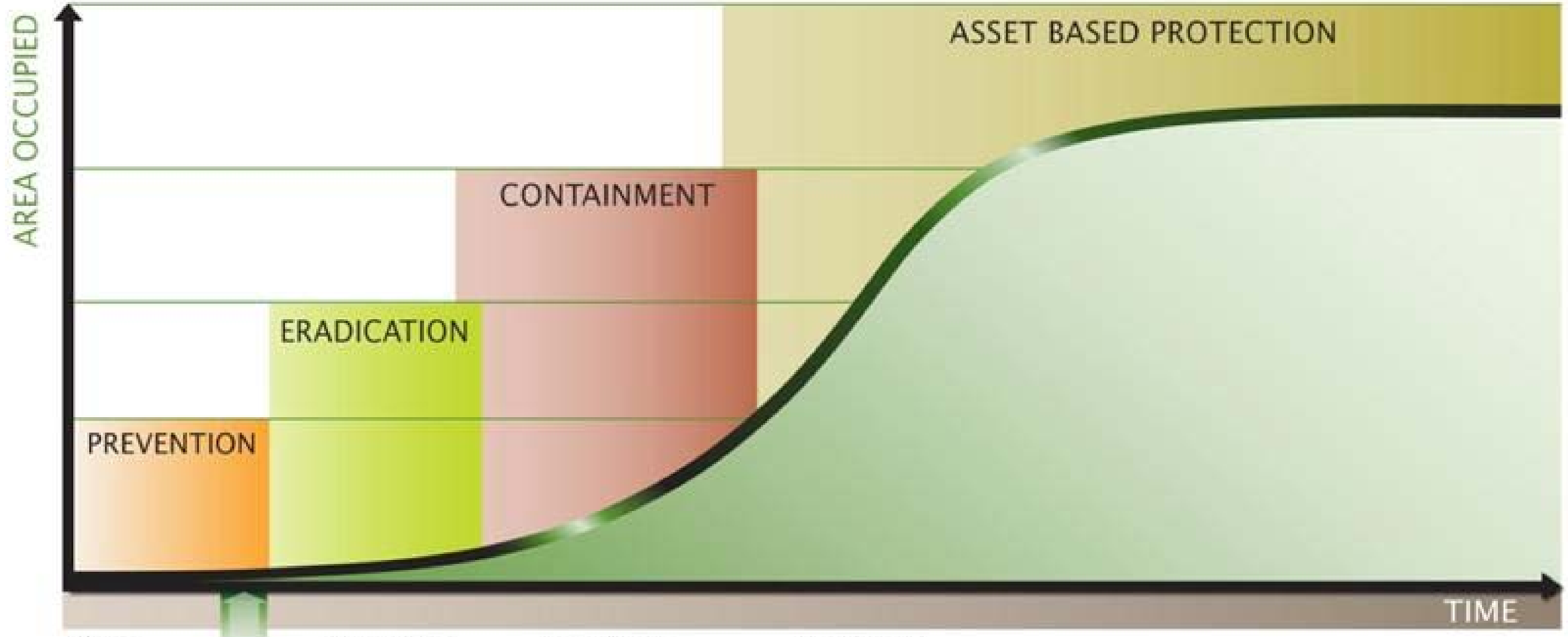
Plants, Mammals, Reptiles, Fish, Invertebrates

Diseases
(Brucellosis, Chronic Wasting Disease, M.ovi, COVID-19

Prevention, Managment/Containment, and Eradication

GENERALISED INVASION CURVE SHOWING ACTIONS APPROPRIATE TO EACH STAGE

Version 1.0: 30 APR 2009

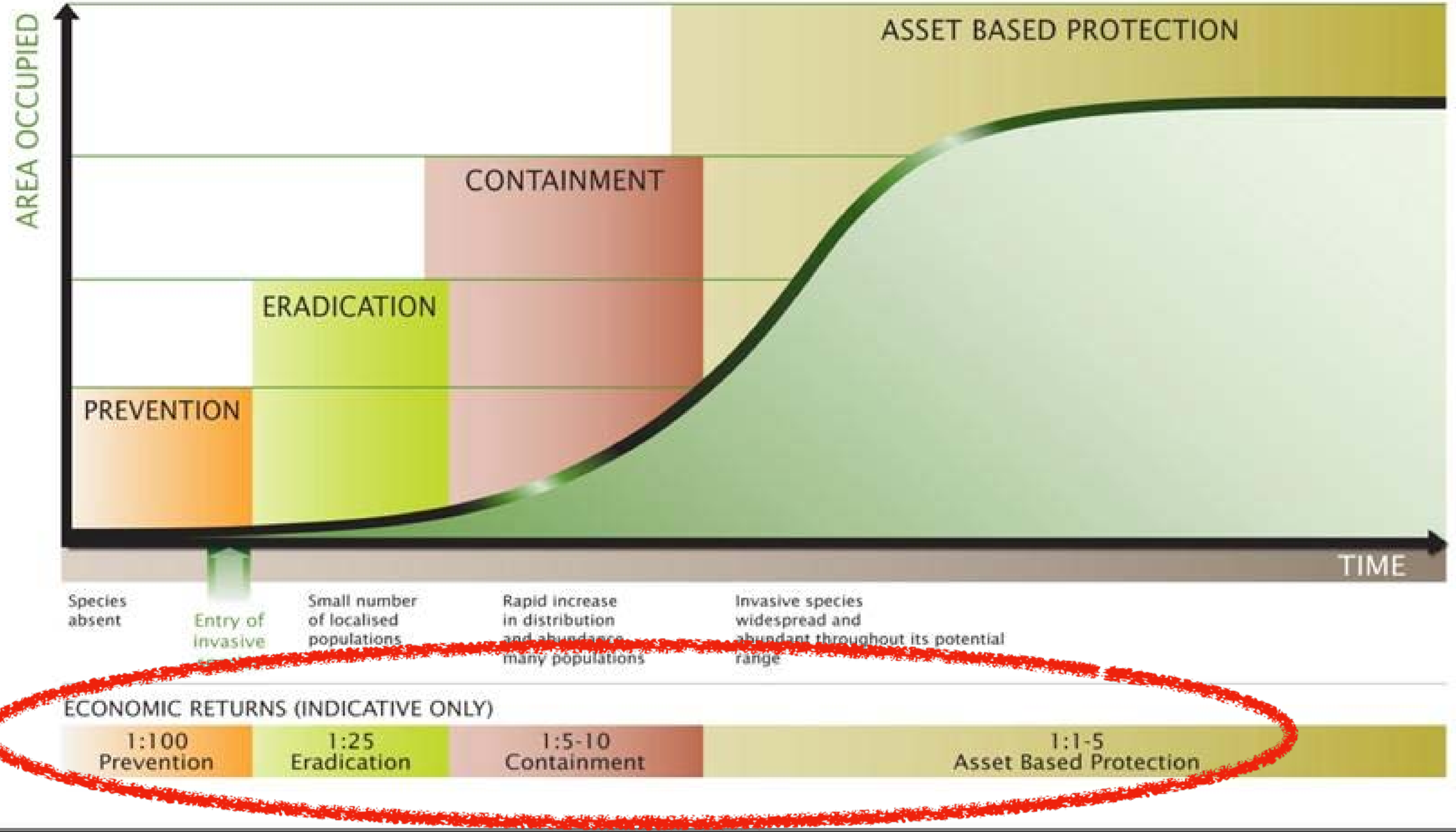


ECONOMIC RETURNS (INDICATIVE ONLY)

1:100 Prevention	1:25 Eradication	1:5-10 Containment	1:1-5 Asset Based Protection

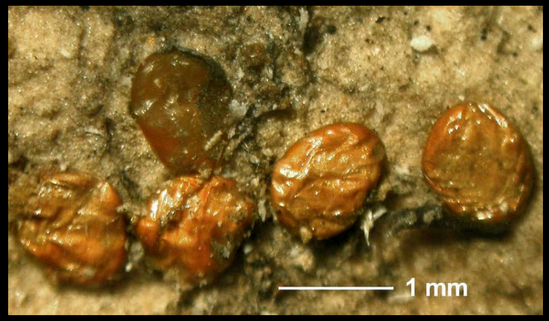
GENERALISED INVASION CURVE SHOWING ACTIONS APPROPRIATE TO EACH STAGE

Version 1.0: 30 APR 2009

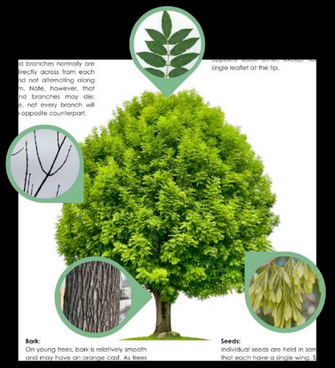


Prevention: Emerald Ash Borer

Adults, Larvae, and Eggs



Ash Wood (Discrimination)



Alberta Mussel Dogs

Inspection = Intrusion

Inspection = Intrusion

Compliance Becomes Engagement

Compliance Becomes Engagement

BBC Wildlife Magazine

Dogs have been herding sheep and sniffing out drugs for years. Now they're saving wildlife too

Conservationists and scientists have realised that the dog's extraordinary sense of smell could be unleashed to detect just about anything.

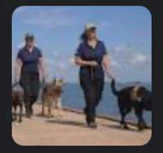
2 weeks ago

CBC

These dogs help keep Alberta free of invasive mussels

A trio of specially trained dogs are on the front lines in Alberta's battle to keep invasive mussels out of the province's water bodies.

Jun 24, 2020



Yahoo News Canada

Alberta sniffer dogs protecting waters from invasive zebra mussels

Alberta is pulling out all the stops to help prevent a disgusting ooze from creeping across the U.S. border. Invasive quagga and zebra...

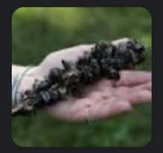
Sep 23, 2015

CTV News

Alberta to use specially trained dogs to sniff out invasive zebra mussels

The Alberta government has teamed up with Montana to pay for specially trained dogs that can sniff out zebra and quagga mussels attached to...

Aug 7, 2014



Adding Invasive Plants

Management and Multi-species Search

Alberta

Conservation K-9 Program

Learn how K-9s are helping to protect Alberta from invasive species.

https://www.alberta.ca/conservation-K-9-program.aspx

Management: Argentine Ants and Lespedeza

Eradication

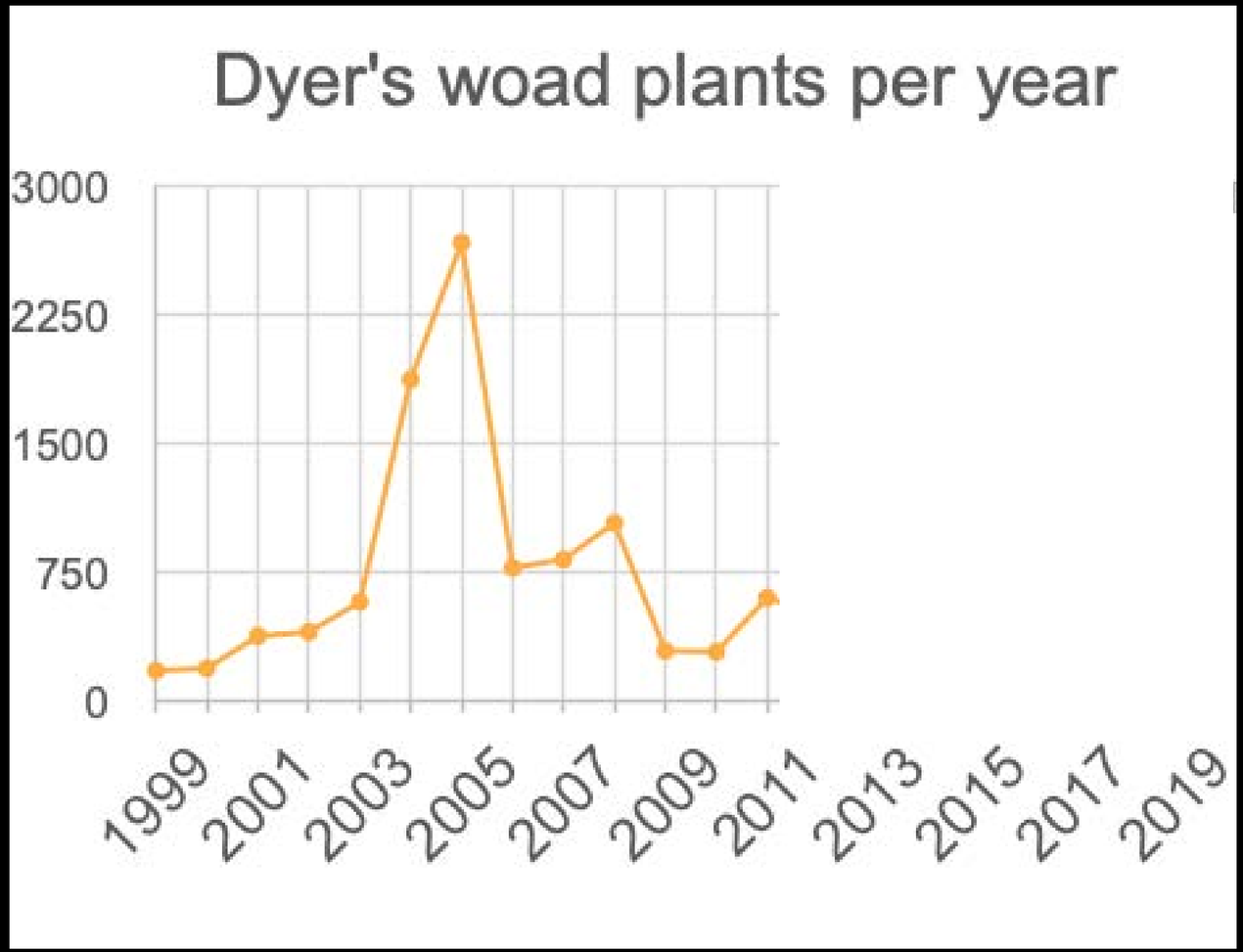
The New York Times

A Very Good Dog Hunts Very Bad Ants

Dyer's woad, *Isatis tinctoria*

- Is a noxious weed in 11 western states
- In Montana, woad is a Priority 1B noxious weed due to its potential impact on ecosystems and its limited presence
- One missed plant = thousands of seeds


Dyer's woad plants per year
3000
2250
1500
750
0
1999
2001
2003
2005

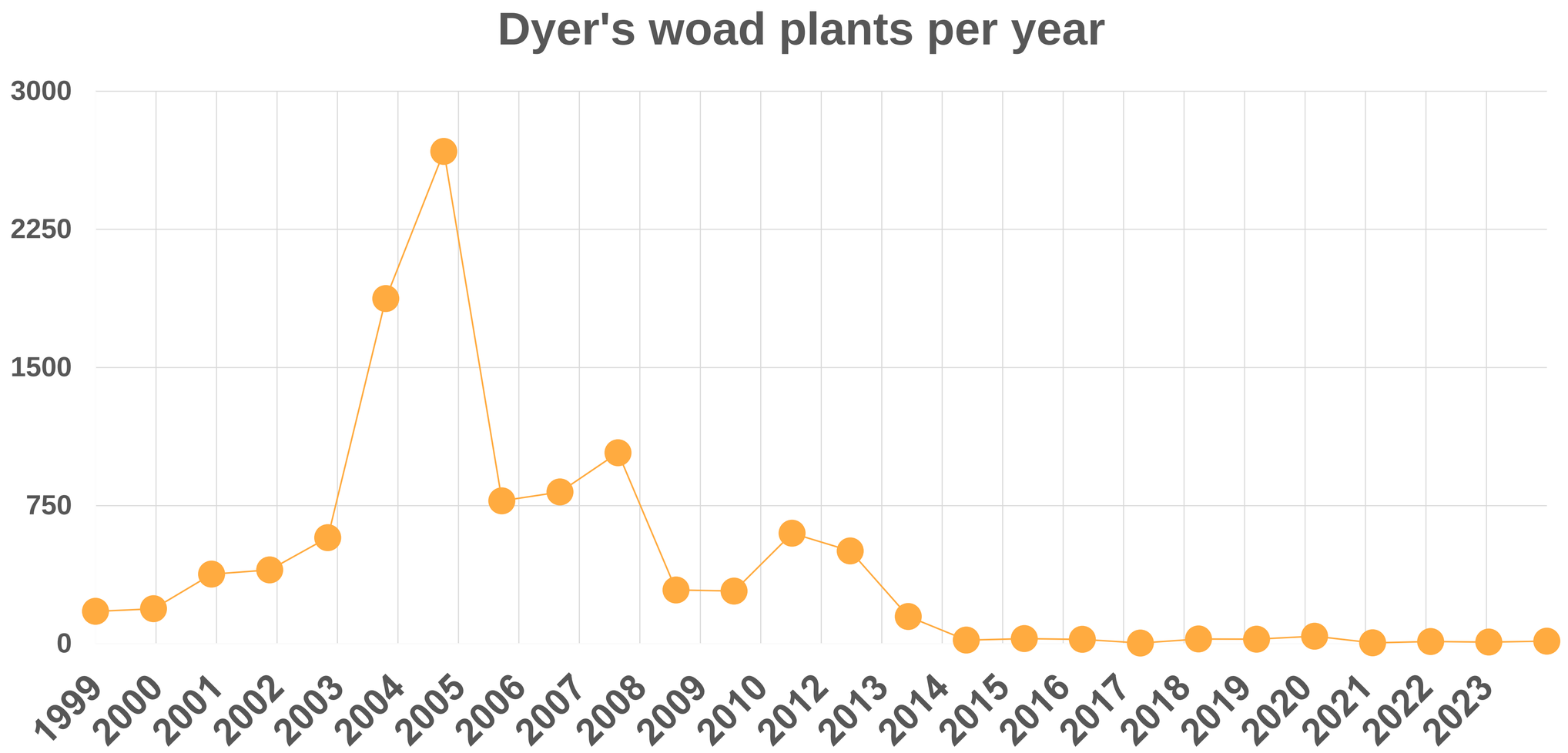

Dyer's woad plants per year
3000
2250
1500
750
0
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019


1A
1B
5A
6A
14
2A
3
15
6B
5B
2B
7A
13?
13
7B
4A
12
4B
5C
10
9
8
11

How’s it going?

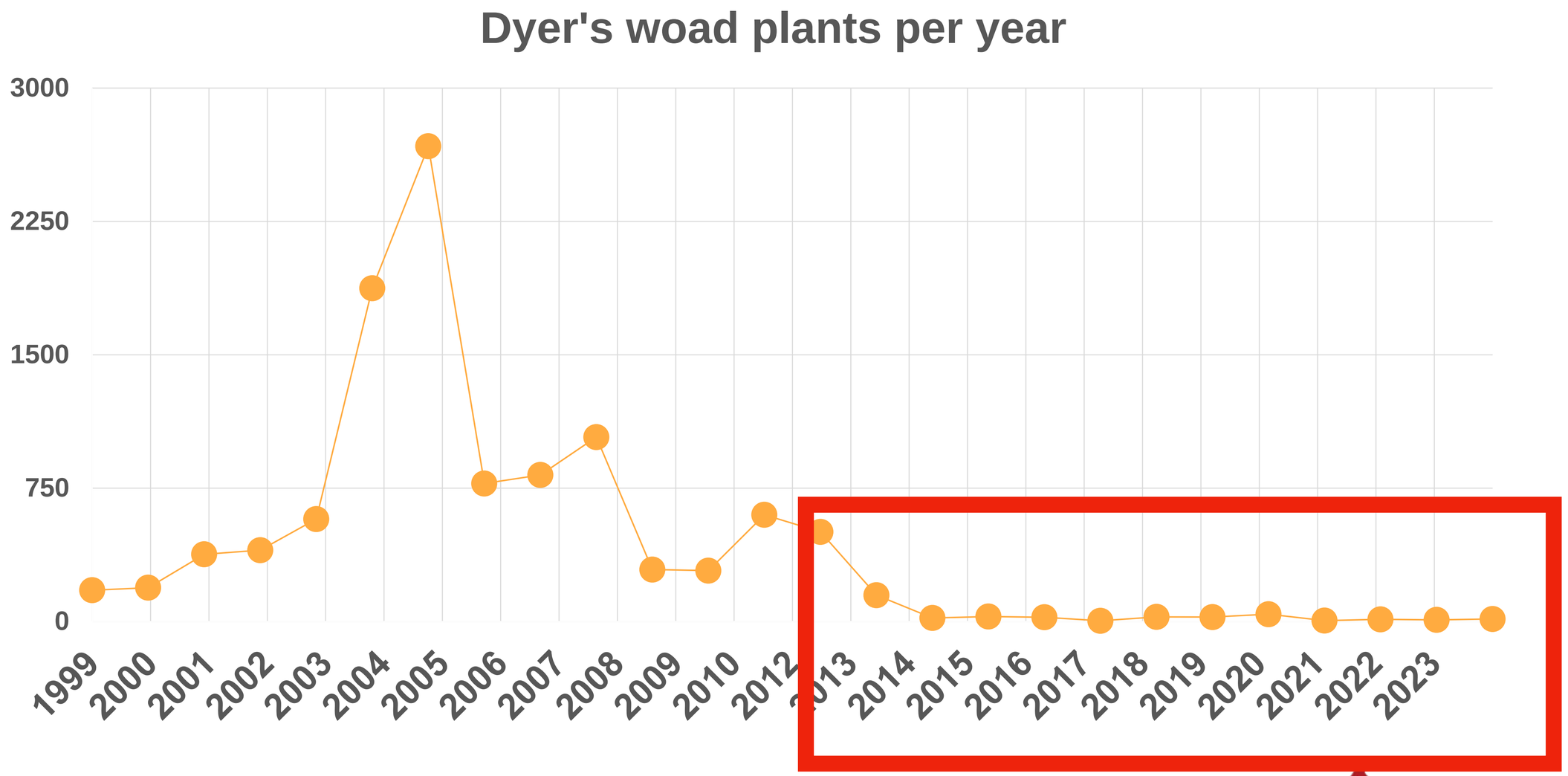
WORKING DOGS for CONSERVATION

How’s it going?

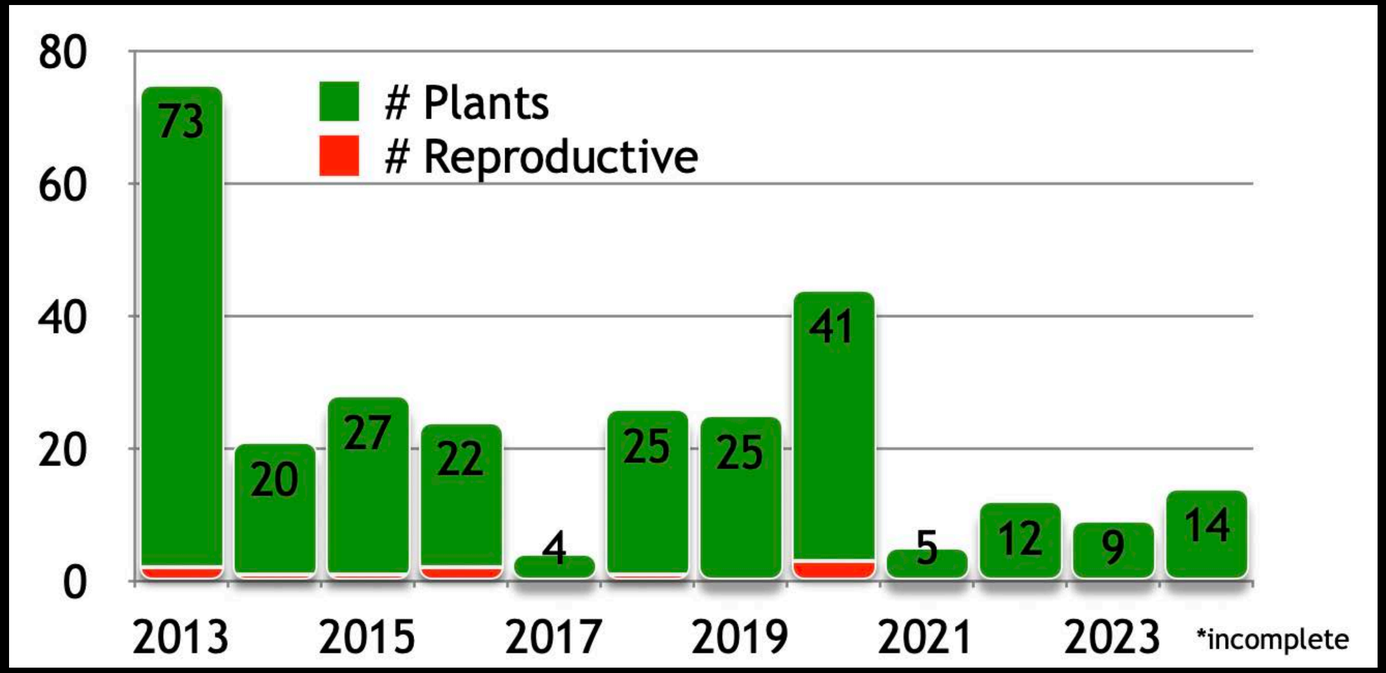


WORKING DOGS for CONSERVATION

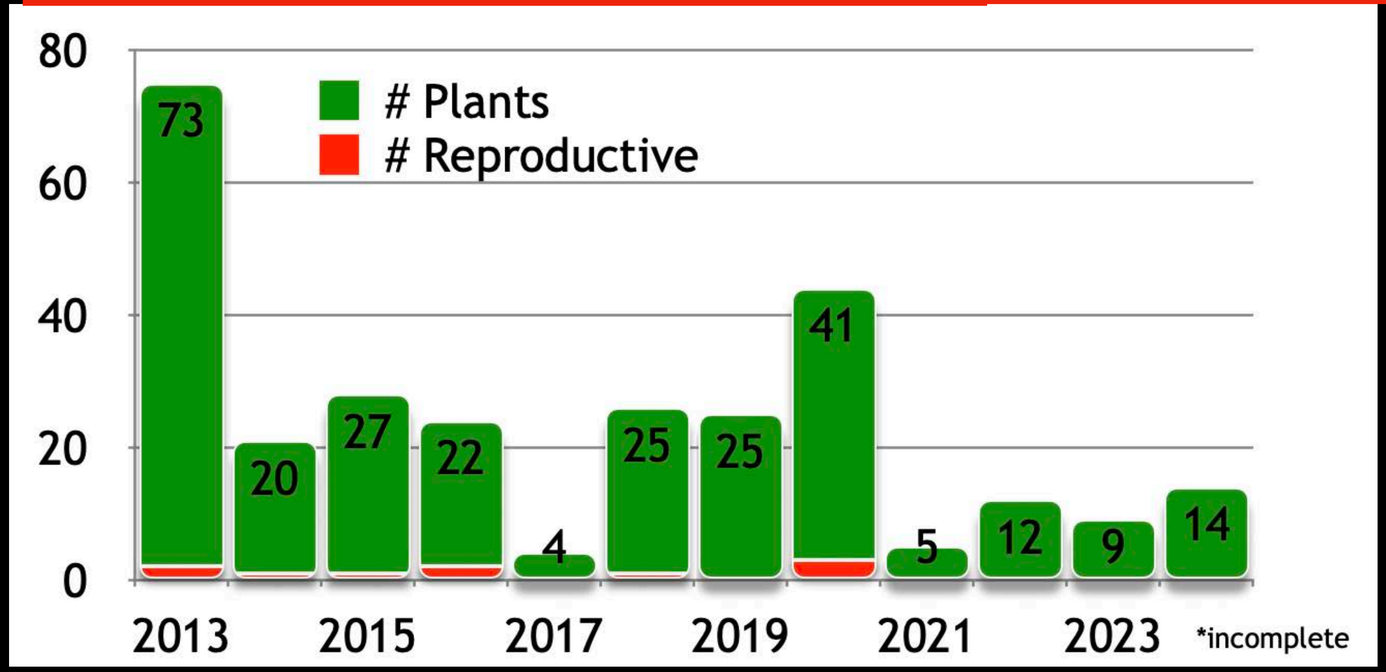
How’s it going?



WORKING DOGS for CONSERVATION


80
60
40
20
0
Plants
Reproductive
73
20
27
22
4
25
25
41
5
12
9
14
2013
2015
2017
2019
2021
2023
*incomplete


FISKARS


80
60
40
20
0
Plants
Reproductive
73
20
27
22
4
25
25
41
5
12
9
14
2013
2015
2017
2019
2021
2023
*incomplete

- *Centaurea stoebe*
- *Lespedeza cuneata*
- *Lespedeza bicolor*
- *Lepidium latifolium*
- *Isatis tinctoria*
- *Centaurea solstitialis*
- *Thesium ramosum Hayne (Alberta Env. & Parks)*
- *Brachypodium sylvaticum (NYNJTC)*
- *Cytisus scoparius (NYNJTC)*
- *Heracleum maximum (Midwest Cons. Dogs)*
- *Tamarix ramosissima*

WORKING DOGS for CONSERVATION

Disease Screening in Free-Ranging Wildlife

Disease Screening in Free-Ranging Wildlife

Lots of Collaborators

Three Big Goals:

1. Real time screening for handled animals

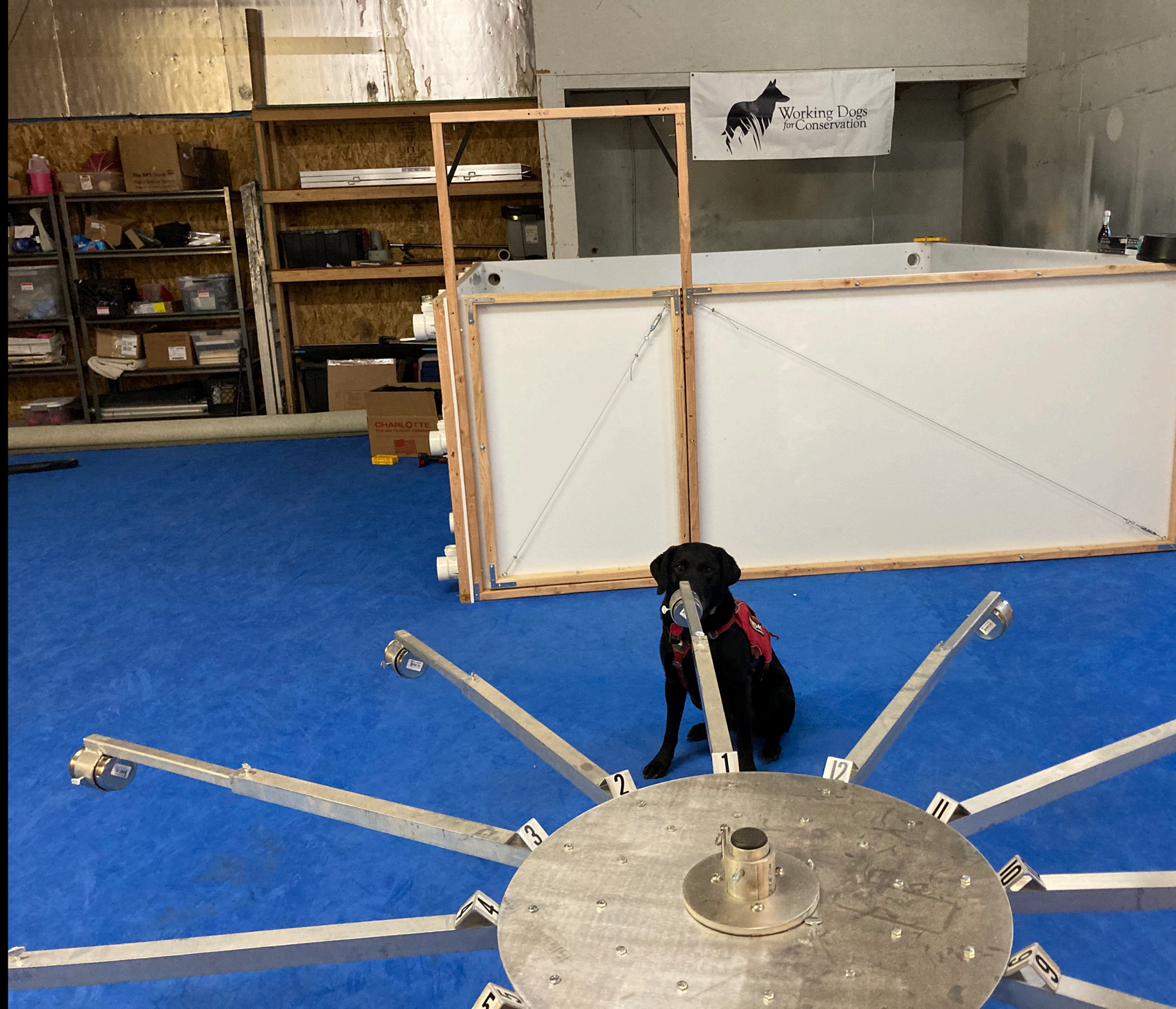
2. Screen animals “on the mountain”

(= habitat assessment? Disease in the environment)

3. K9-Support to Maintain Spatial Separation

TOP IMAGE FROM: “High Plains Wild” — filmmaker Mariah Lundgren

The Scent Wheel



Double Blind & Offsite Screening

Double Blind & Offsite Screening

Camera for Remote Observation

Double Blind & Offsite Screening

Camera for Remote Observation

Double Blind & Offsite Screening

Target in #2

Double Blind & Offsite Screening

Distractor Odors

(cat food, blank fliter, hair gel, coffee, scat from uninfected sheep)

Double Blind & Offsite Screening

Proof of Concept Summary:

Sensitivity (SE), Specificity (SP), Accuracy (A)

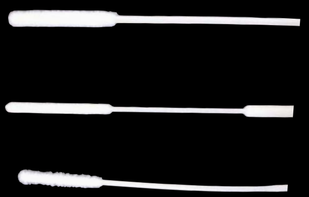
Successful Discrimination of:

Sheep:

- M.ovi +/- masks (autoclaved) (SE: 100%, SP:69%, A:84%)
- M.ovi +/- dung (SE: 73*-100%, SP:94-100%, A:91-100%)

Humans:

- SARS-COV-2 +/- human nasal swabs (SE: 100%, SP:84.5%, A:93.8%)



M.ovi Culture:

- M.ovi culture vs. Mannheimia + (SE: 100%, SP:96%, A:97%)

Proof of Concept Summary:

Sensitivity (SE), Specificity (SP), Accuracy (A)

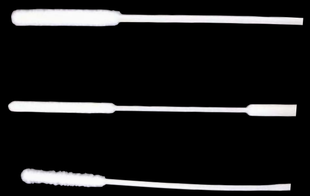
Successful Discrimination of:

Sheep:

- M.ovi +/- masks (autoclaved) (SE: 100%, SP:69%, A:84%)
- M.ovi +/- dung (SE: 73*-100%, SP:94-100%, A:91-100%)

Humans:

- SARS-COV-2 +/- human nasal swabs (SE: 100%, SP:84.5%, A:93.8%)



M.ovi Culture:

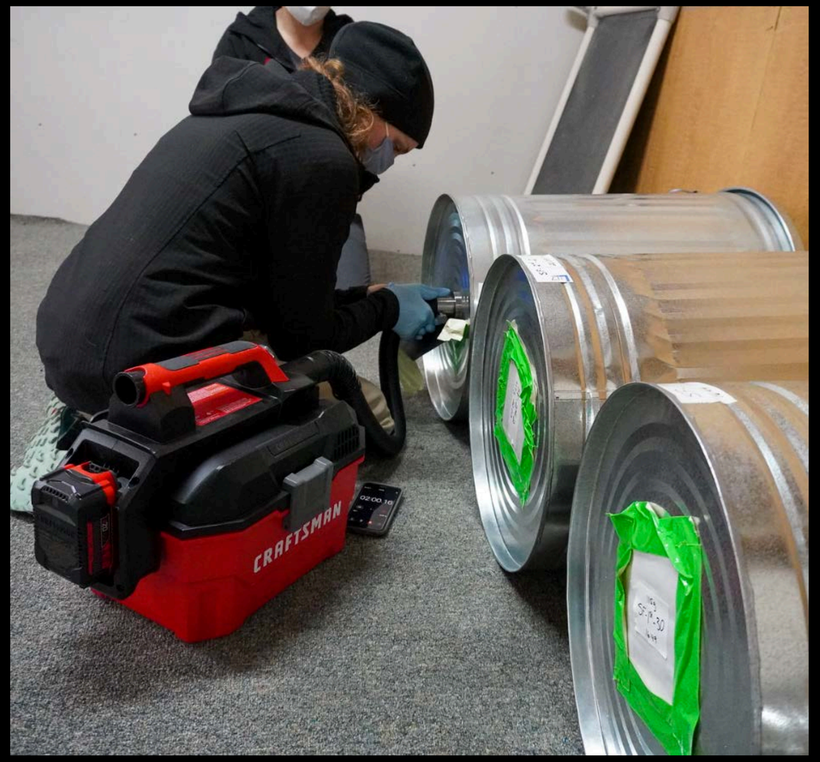
- M.ovi culture vs. Mannheimia + (SE: 100%, SP:96%, A:97%)
- UNSUCCSESSFUL recognition of M.ovi +BHSscat. (SE: 0, SP:74%, A:65%)

Technical vs. Workflow Feasibility

Benny (Trained by WD4C) and Det. Lauren Wendt

Photo: Isabelle.Groc

Remote Air Sampling for Canine Olfaction (RASCO)




porta brace

USA TODAY
A GANNETT COMPANY

Montana's Blackfeet Tribe to use dogs to sniff out disease and contaminants

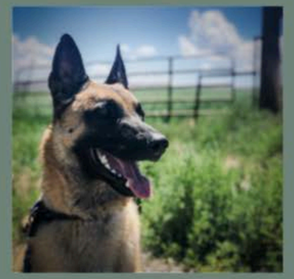
Aaron Bolton Kaiser Health News

Published 2:25 p.m. ET June 30, 2022 | Updated 2:34 p.m. ET June 30, 2022

Montana

Michele Vasquez (left) and researcher Souta Calling Last sit with Charlie, a Lab trained to detect several scents for Working Dogs for Conservation. *Aaron Bolton For KHN*

Browning: A Blackfeet researcher has received a $75,000 federal grant to run a yearlong study to train dogs to sniff out chronic wasting disease and toxic waste that might otherwise be ingested by people who hunt wild game and gather traditional plants. The project aims to protect tribal members' health by letting them know where the disease has been detected and where toxic waste has been found to preserve safe spaces to conduct traditional practices, Kaiser Health News reports. Chronic wasting disease has been detected in just one white-tailed deer on the Blackfeet reservation, but once it's present, it's impossible to eradicate, according to wildlife managers. The disease is already forcing tribal members to alter or abandon some traditional practices, said Souta Calling Last, executive director of the nonprofit cultural and educational organization Indigenous Vision. And some families depend on meat from the deer, elk or moose they can hunt several months out of the year. That's where the dogs come in for Calling Last's study. Standing near a wetland full of cattails, she said the dogs trained by the nonprofit organization Working Dogs for Conservation will detect chronic wasting disease in deer and elk scat at such sites that serve as watering holes for herds. The dogs also will sniff out mink and otter scat so it can be tested for chemicals and contaminants in illegal



RECENT PRESS

OUR DOGS HELP RAISE AWARENESS

A recent deployment to Yellowstone National Park reinforced what we already know: dogs attract press that otherwise might chase other stories. During just a two-week deployment, a dog and handler team inspired over a dozen print, TV, and radio stories. They also educated over 1500 people about Aquatic Invasive Species and Conservation Detection Dogs.

The New York Times

A WESTERN SHOWDOWN WITH MUSSELS

"Exercises like these are fun for Wicket, but they are deadly serious to her handlers... State officials want desperately to keep the mussels out of blue-ribbon trout streams and pristine mountain lakes."

- Read the full article here.

npr

THE LATEST IN SCIENTIFIC FIELD EQUIPMENT? FIDO'S NOSE.

" 'Many field biologists spend their careers trying to get samples from extremely rare and reclusive species.' I thought, 'There's got to be a better way,' [Megan Parker] says. 'For us, dogs are that better way.' "

- Read the full article here.

SCIENTIFIC AMERICAN

SHELTER DOGS ARE HELPING SCIENTISTS SNIFF OUT THE WORLD'S RAREST GORILLAS

"While the dog teams struggled with some of the most difficult and rugged terrain - held back by their less-nimble handlers - they still came out on top [compared to human-only teams]."

- Read the full article here.

IDAHO STATE JOURNAL

SNIFFING OUT TROUBLE: DOGS TRAIN IN POCATELLO FOR NOXIOUS WEED DETECTION

""The weed world is a visual world. By the time a (weed) is flowering and gets noticed, it's almost an epidemic," Pettingill said. "If we catch it before flowering, we can get ahead.""

- Read the full article here.

Jackson Hole News&Guide

BOATERS BEWARE: MUSSEL-SNIFFING POOCHES ARE HERE

"Locating the planted vial, which contained a sampling of a potentially ecology-devastating aquatic species, was the task at hand. Within seconds Jax found and snout-swatted the vial from its hiding place on the National Park Service vessel."

- Read the full article here.


IVAN
ELIAS
JOHNE

Takeaways

Dogs can Enable and Streamline Biosecurity
(Efficacy, speed and flexibility can all be important.)

Build in Lead Time!
(Dog Sourcing, Sourcing training samples, training, site acclimatizing, etc.)

Plan WORKFLOW along with TARGET
(And combine dogs with other tools like bait stations, traps, etc.)

Biosecurity is Difficult (= Beware of “Ted and His Terrier”)
(Safety, non-targets, and the costs of errors are all considerations)

Thank you!
Please Reach Out!

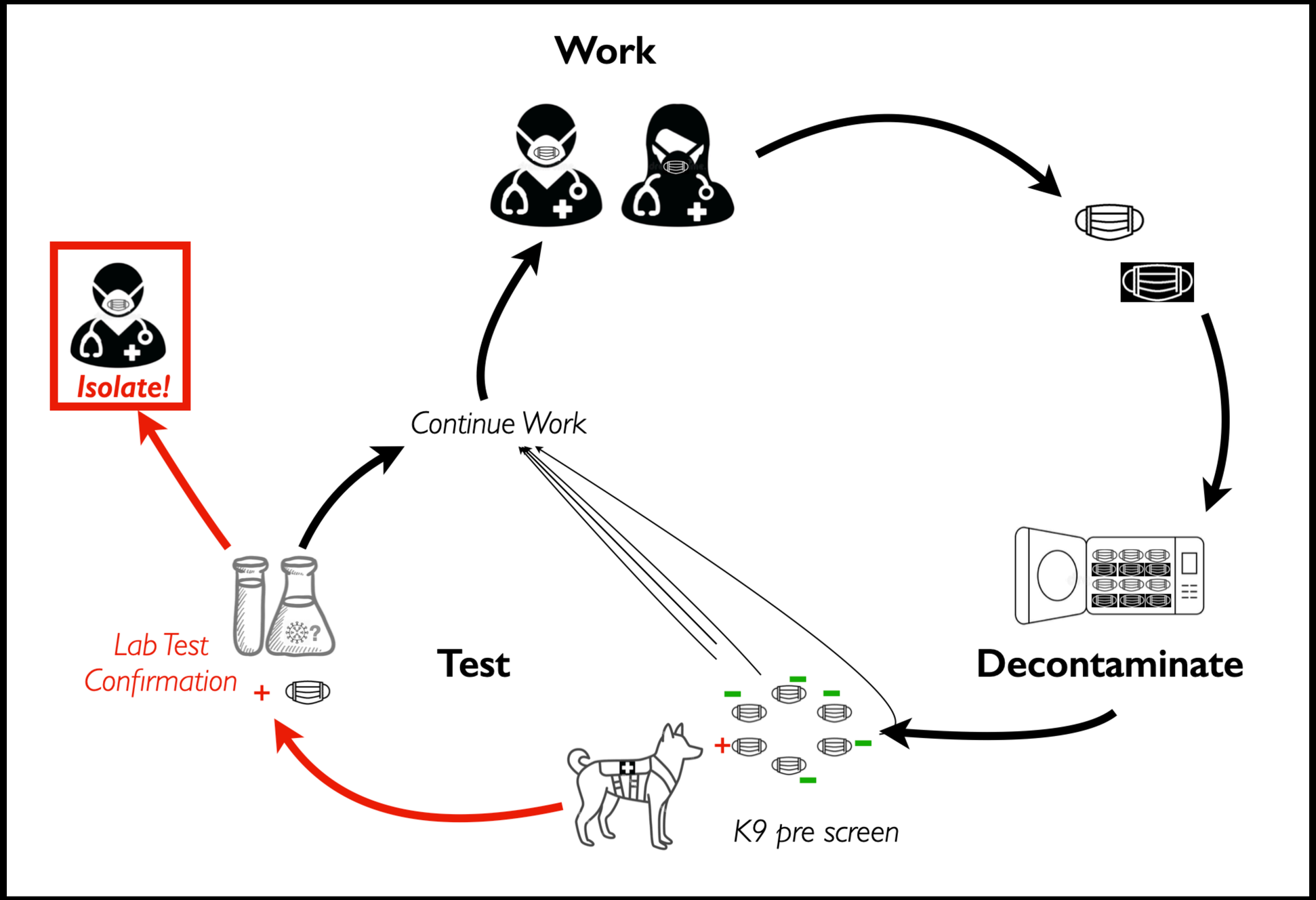
WORKING DOGS *for* CONSERVATION

Pete Coppolillo (he, him)
Executive Director
Pete@WD4C.ORG
+1 406 290 9453

Aimee Hurt
Director of Special Projects, WD4C
Aimee@WD4C
+1 (406) 5291943

Cindy Sawchuk
Invasive Species Program
Alberta Environment and Parks
cindy.sawchuk@gov.ab.ca
+1 (403) 308-1274

WD4C.org


Work
Isolate!
Continue Work
Lab Test
Confirmation
Test
Decontaminate
K9 pre screen

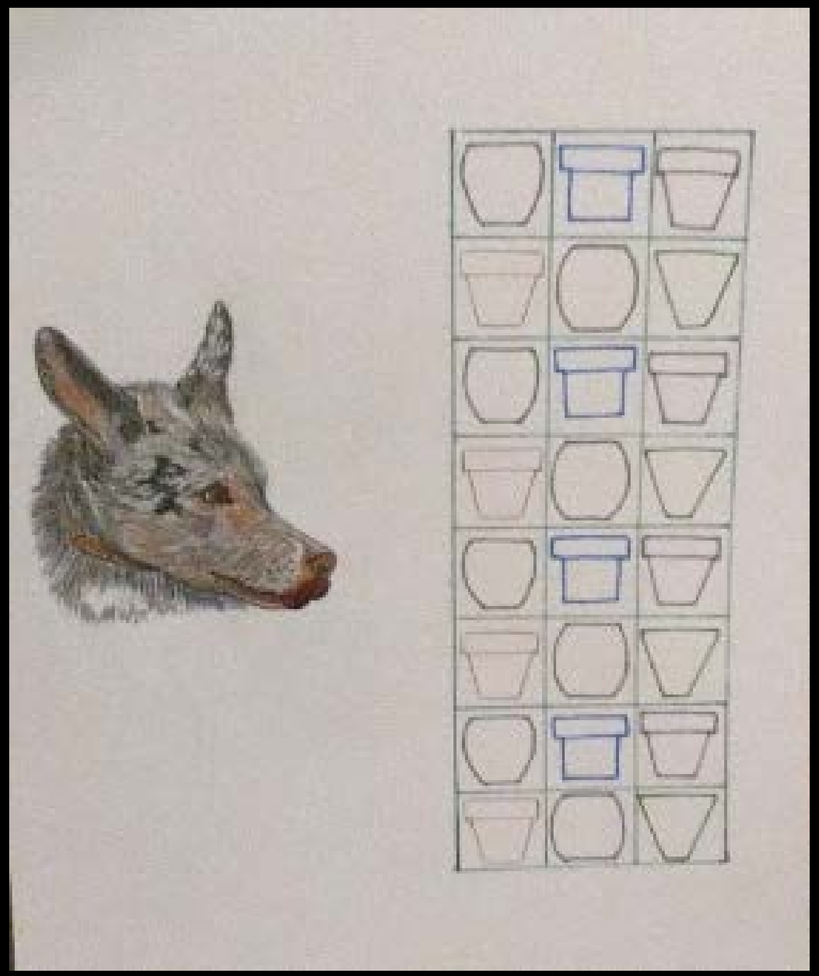
3 Key Factors:

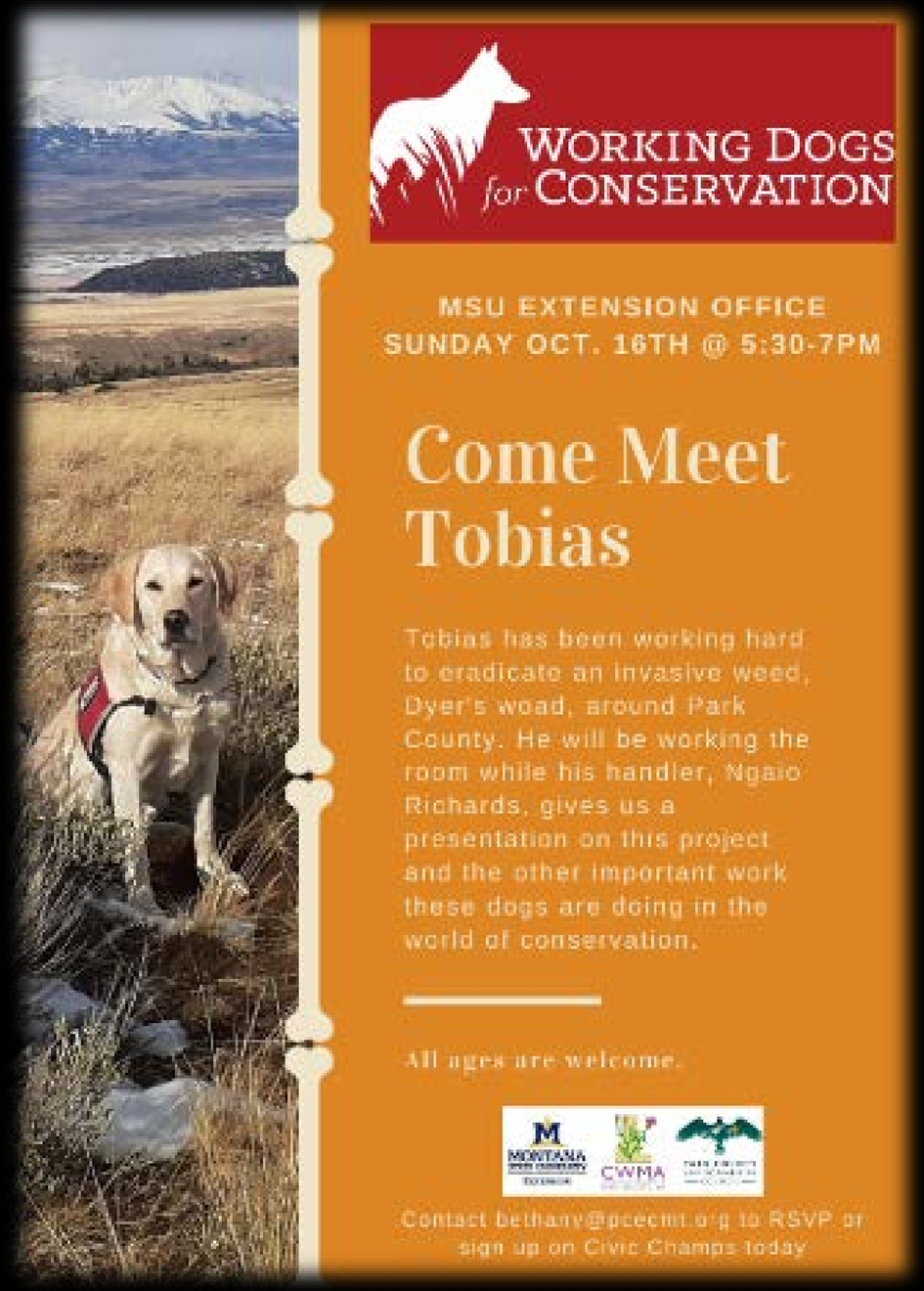
Better detection

Earlier Detection

Better Biology

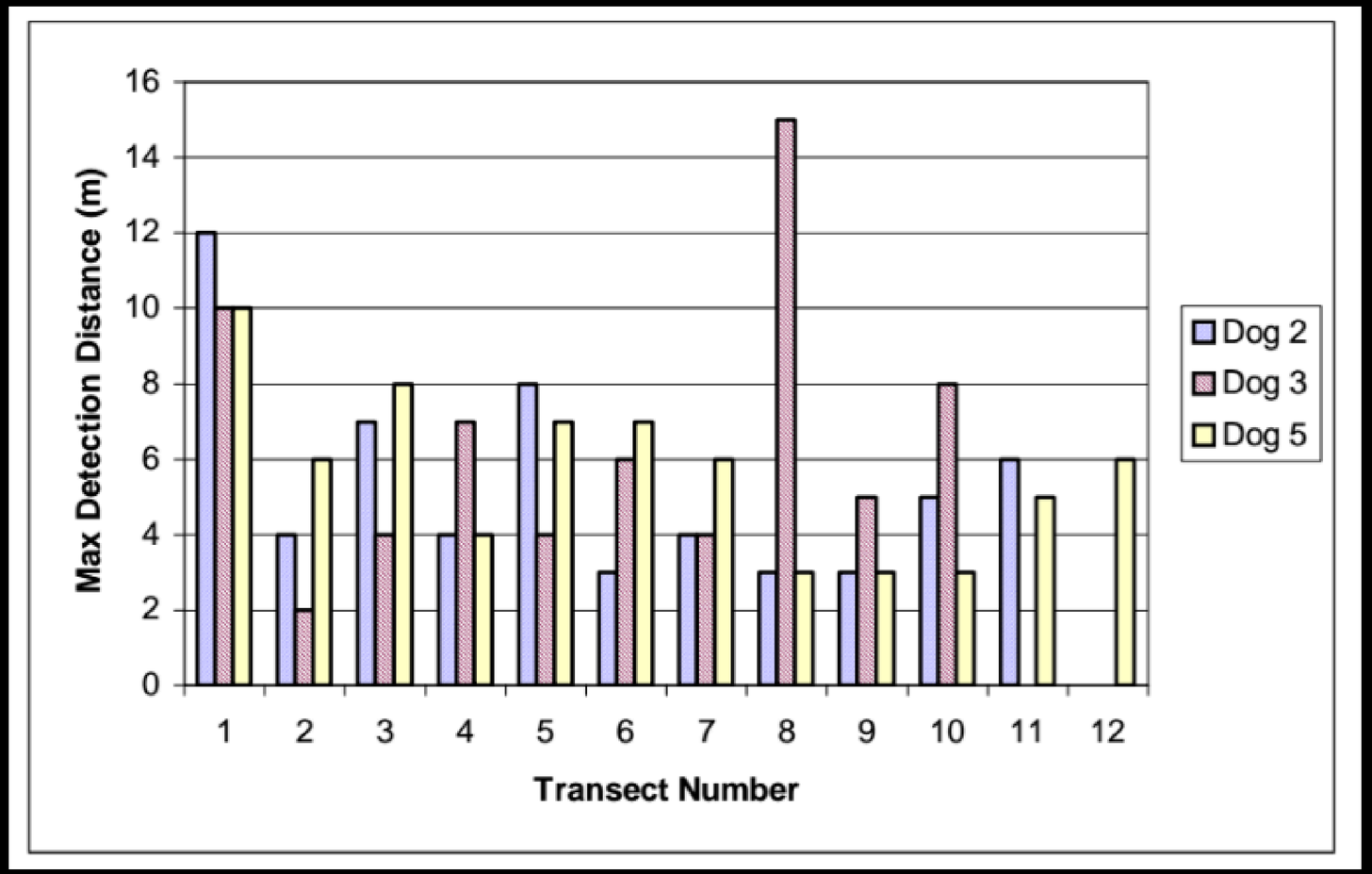
Community Engagement





Plebejus icarioides fenderi


Lupinus sulphureus kincaidii



5 Dogs

n = 378 trials

98.4% accuracy

Invasive Plant Science and Management 2010 3:113–121

Research

Trained Dogs Outperform Human Surveyors in the Detection of Rare Spotted Knapweed (*Centaurea stoebe*)

Kim M. Goodwin, Rick E. Engel, and David K. Weaver*

Invasive plants have devastating effects on ecosystems and biodiversity that early intervention can prevent. Eradication or containment of new invasions is difficult to achieve because of constraints posed by the low density and detectability of individuals. Domestic dogs trained to cue on distinctive scents might provide an effective method to detect spotted knapweed. The objective of this study was to compare the accuracy and detection distances of dogs to humans in locating new spotted knapweed (*Centaurea stoebe*) invasions. Three dogs, trained to detect knapweed using scent discrimination and tracking techniques, were compared with human surveyors. Seven sampling units (0.5 ha [1.2 ac]) were delineated in a grazed dryland pasture. Dogs, with their handlers, and human surveyors performed line-transect surveys in fall 2005 and spring, summer, and fall 2006. Dog accuracy for large-size knapweed targets (infestations 0.52 m^3 [18.4 ft^3]) was similar to human accuracy and better than humans (94 vs. 78%) for medium-size targets (infestations 0.13m^3). Dog accuracy (67%) was greater (> 81% probability) than humans (34%) for small targets (plants; 0.02 m^3). Overall dog accuracy (81%) and *F*-measure scores (86%) were better than human scores, 59% and 74%, respectively. Human precision was greater (100%) than dogs at 94%. Dogs detected a larger percentage of small targets (80%) at distances greater than 7.9 m (26 ft) compared with humans at only 20%. Our results indicate dogs are more accurate than humans are, especially at critical detection of small spotted knapweed plants, and from greater distances. Invasive plant monitoring using detection dogs can provide greater overall accuracy of plant detection.

Nomenclature: Domestic dogs, *Canis familiaris* L.; spotted knapweed, *Centaurea stoebe* L.

Key words: Weeds, rangeland, eradication, rare plant monitoring, vapor detection, search dog.

Invasive plants can replace native species (Dukes and Mooney 2004), alter ecosystem function and threaten biodiversity (Braithwaite et al. 1989; Musil 1993), and cause damaging economic effects for land managers in western North America. Early detection and containment or eradication of new invasions can slow their spread (Moody and Mack 1988), prevent future weed problems (Hobbs and Humphries 1995), and reduce ultimate management costs (Higgins et al. 2000). Eradication requires near-perfect control for many years, yet finding juvenile and small adult plants is challenging (Tomley and Panetta 2002), and sampling becomes increasingly difficult on large sites as management reduces weed density over time (Panetta 2007). The detection of rare individuals, or those occurring in low abundance in an area of occupancy (Gaston 1997), is a common problem but is critical for invasive plant eradication and important for accurate and unbiased occupancy estimates of rare native species (MacKenzie et al. 2002).

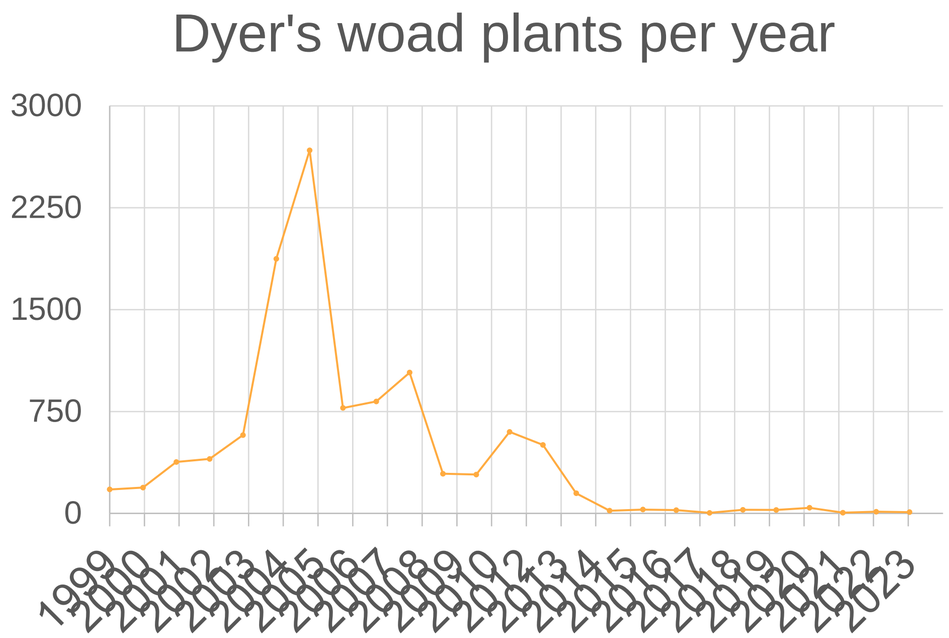
Domestic dogs, trained to search for the presence of specific odors and referred to as detection dogs, might provide an effective and reliable detection method for rare plants based on their ability to cover large areas thoroughly (Killam 1990) and to accurately discriminate specific odors (Williams and Johnston 2002). For example, detection dogs with associated handlers have been used to locate buried land mines (McLean 2003), human remains (Killam 1990), cadavers (Rebmann et al. 2000), desert tortoises

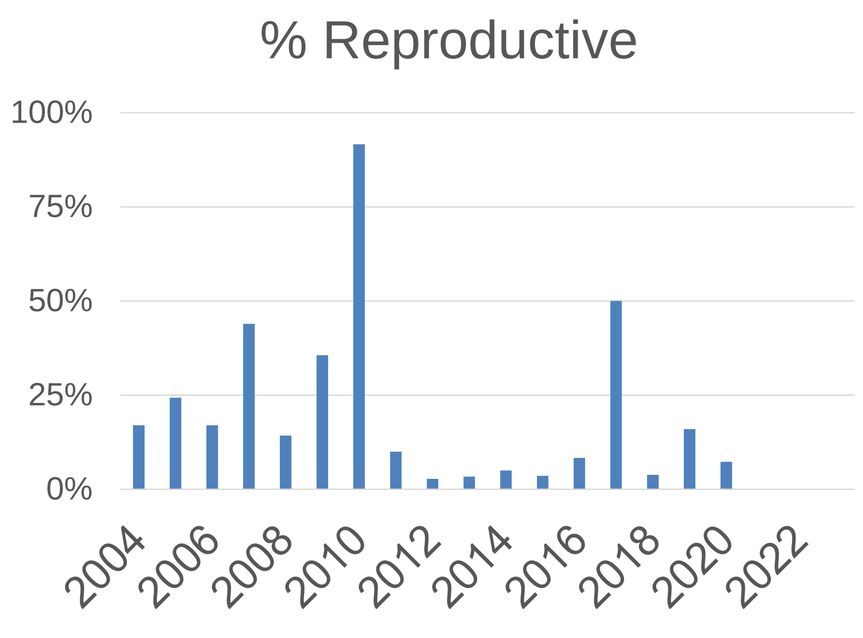
DOI: 10.1614/IPSM-D-09-00025.1

* Graduate Student, Associate Professor, and Associate Professor, Department of Land Resources and Environmental Sciences, Montana State University, Bozeman, MT 59717. Corresponding author's E-mail: kgoodwin@montana.edu

Goodwin, Kim M., Rick E. Engel, and David K. Weaver. 2010. "Trained Dogs Outperform Human Surveyors in the Detection of Rare Spotted Knapweed (Centaurea Stoebe) | Invasive Plant Science and Management | Cambridge Core." *Invasive Plant Science and Management* 3: 113–21.

Dyer’s woad, Missoula, Montana





WORKING DOGS for CONSERVATION


Dyer's woad plants per year
3000
2250
1500
750
0
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019

New Lab Techniques and Complementary Technologies

TABLE 4 Performance of WDD compared to other monitoring methods for 617 cases. Numbers in brackets refer to scientific cases only. For the 69 cases where WDD did not perform better than any other monitoring method, reasons are given. #mentions—number of cases from 69 where this reason has been mentioned, multiple mentions are possible

Performance of WDD	Better	Equal	Worse	Mixed results
Number of cases	542 (359)	15 (13)	6 (5)	48 (45)
Summary cases	542	69		
Reason	**Description**			**# Mentions**
Training	The behaviour of the dog pointed out training mistakes, for example, too high specificity			37
Density of target	Scent pools confuse dogs or low target densities frustrate dogs			26
Study design	The use of a detection dog does not fit to the study, for example, too many target objects			21
Target	Size of target can easily be detected by humans or target has only little smell			20
Season and weather	Seasonality of species, temperature and rainfall affect detectability			14
Area and habitat	Density of vegetation affect detectability or dangerous habitat (e.g. cliffs)			13
Individual differences	Personality or ability of individual dog does not fit the function (e.g. assistance dog does not leave handler)			12
Cost considerations	Much higher costs for dog and logistics than for other methods do not justify their use			9
Verification issues	Usually when a generalised dog was used for a specialised target and genetic verification was necessary			3

Community Engagement