A person wearing a black tactical vest is aiming a rifle in a dense, lush green forest. The rifle is the central focus, pointing towards the right. The background is filled with various types of green plants, including ferns and broad-leafed trees. The lighting is bright, suggesting a sunny day. A semi-transparent black box with white text is overlaid on the upper right portion of the image.

Operational performance of a Herbicide Ballistic Technology (HBT) helicopter platform targeting incipient populations of Miconia (*Miconia calvescens*) in Hawaiian Watersheds

For video rendition please visit:

<http://www.youtube.com/watch?v=988i6SQKSzY>

Codename: Hot Mic

Mission: Calibrate helicopter surveillance operations with real-time HBT target reduction capabilities

Operators: Portside pilot/applicator configuration

Batch: G4U200 with Garlon® 4 Ultra (200mg triclopyr per 0.68 caliber projectile)

Performance: 30 m effective range with sub-meter accuracy

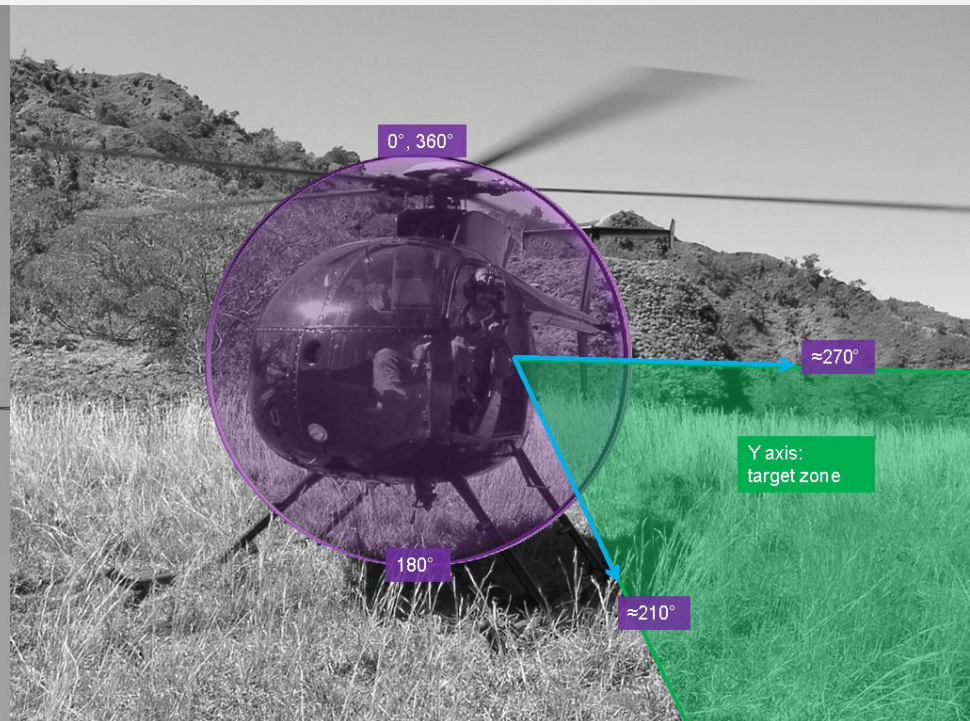
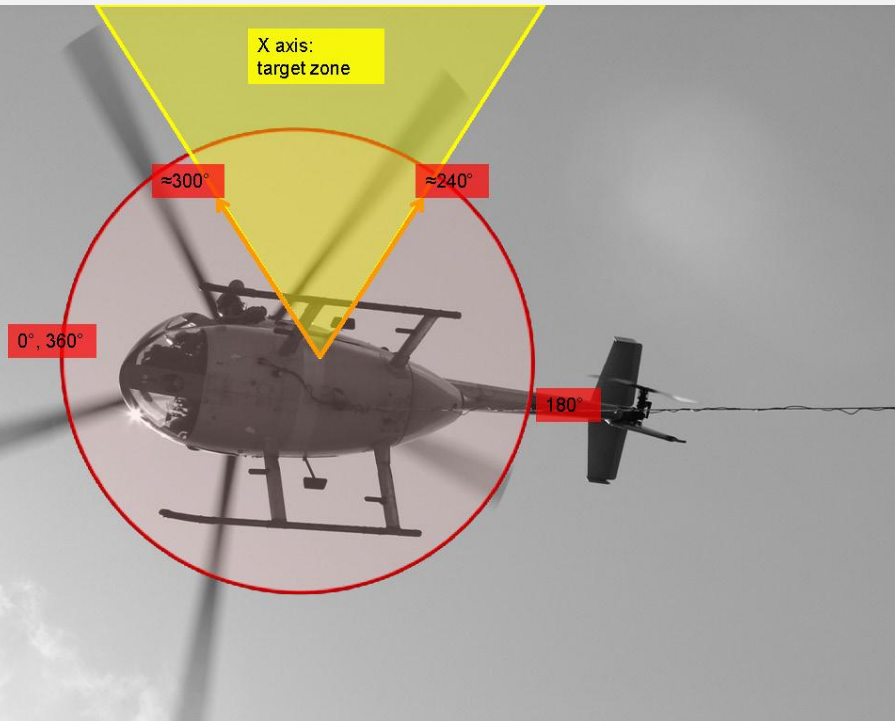
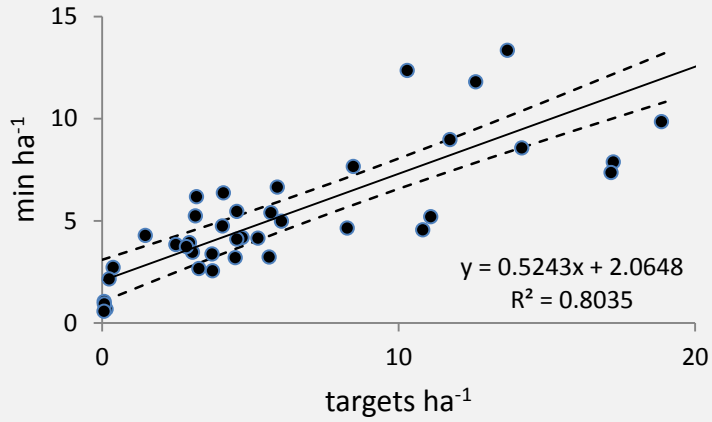


Diagram courtesy of J. Beachy 2009

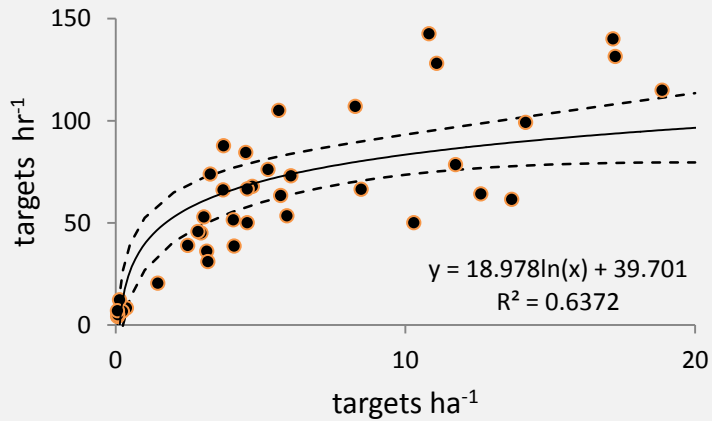
Operational Performance of the HBT Platform (n=43)



Search efficiency (SE)

Time on target 32 sec

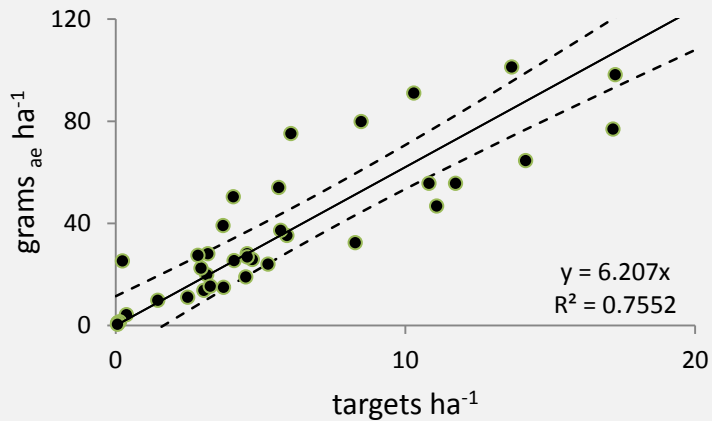
1 ha searched in 2.1 min w/ no targets detected



Target Acquisition Rate (TAR)

TAR exceeds 1 target min^{-1} at 5 targets ha^{-1}

TAR_{max} threshold at 10 targets ha^{-1}

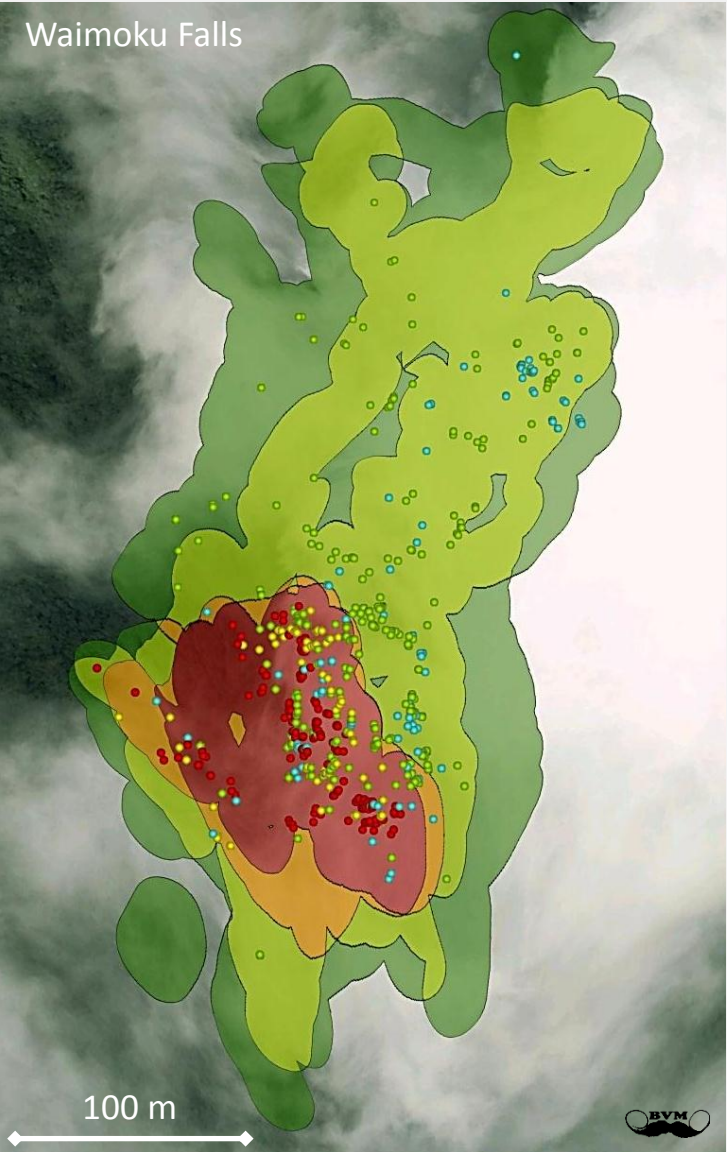


Herbicide Use Rate (HUR)

Target dose rate is 6.2 g triclopyr (ca. 31 projectiles)

34 of 43 ops were < 1% of the maximum label rate

Monitoring Target Reduction with Search Saturation

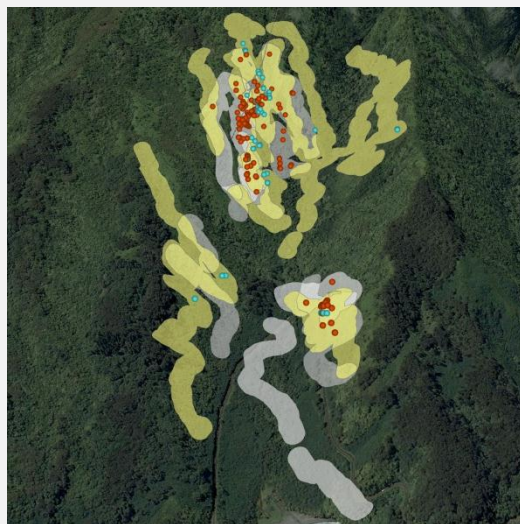


	Targets	Area (ha)	Notes
<i>Operations</i>		<i>Resources and Performance</i>	
Sept 2011	187	3.1	<ul style="list-style-type: none"> Ops Flight Time (FT_{ops}): 10.9 hrs Targets Acquired (TA)/Survivors: 678/21 Ops Treatment Efficacy (TE_{ops}): 0.97 Detection Efficacy (DE): 0.72
Nov 2011	72	3.9	
Feb 2012	329	23.9	
May 2012	111	20.6	
<i>Search saturation</i>		<i>Outcomes</i>	
1x	23 (0.03)	8.1 (38%)	<ul style="list-style-type: none"> Only 55% of the targets found on the first search across all saturation levels >90% reduction occurs in 4x saturation (but only 58% of targets in 12% of total searched area)
2x	235 (0.34)	10.0 (46%)	
3x	35 (0.05)	0.9 (4%)	
4x	406 (0.58)	2.5 (12%)	
<i>Search acquisitions</i>		<i>Projections to achieve 4x saturation</i>	
1 st	383 (0.55)	--	<ul style="list-style-type: none"> TA: 30-58 targets 2 operations (MF: 0.50-0.70) FT_{ops}: 1.8-2.2 hrs Complete 500m buffer: 2 hrs Ft_{ops} to search 57 ha with no targets detected
2 nd	151 (0.22)	--	
3 rd	133 (0.19)	--	
4 th	32 (0.05)	--	

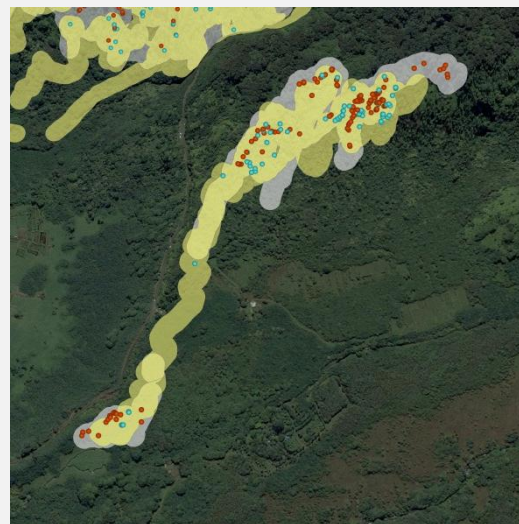
Operations (points) Search saturation (polygons)

● Sept 2011	■ 1x
● Nov 2011	■ 2x
● Feb 2012	■ 3x
● May 2012	■ 4x

Double search saturation on three incipient populations



Nuuailua



Keanae Makai



Wailua Wall

	May 2012	June 2012	May 2012	June 2012	May 2012	June 2012
Area (ha)	27.8	45.0	7.8	12.3	25.4	14.9
FT _{ops} (hrs)	2.1	1.9	1.1	1.4	2.2	1.0
Targets*	151 (57/94)	67 (24/43)	146 (17/129)	83 (2/81)	128 (59/69)	37 (0/37)
2x sat. (ha)	--	11.5	--	6.5	--	8.0
DE	0.69	--	0.61	--	0.65	--
Projection**	95/8.9hr		124/4.9hr		81/6.5hr	

Notes:

* Single/double saturation; ** remaining targets/FT_{ops}

DE = 0.61-0.69; OTE = 1.0 (no survivors recorded in June)

SE (min ha⁻¹) improves 29% from first to second search operation due to target reduction

2x saturation zone represents only 22% of total search areas, but 74% of recorded targets

Recorded miconia targets: 2006-11

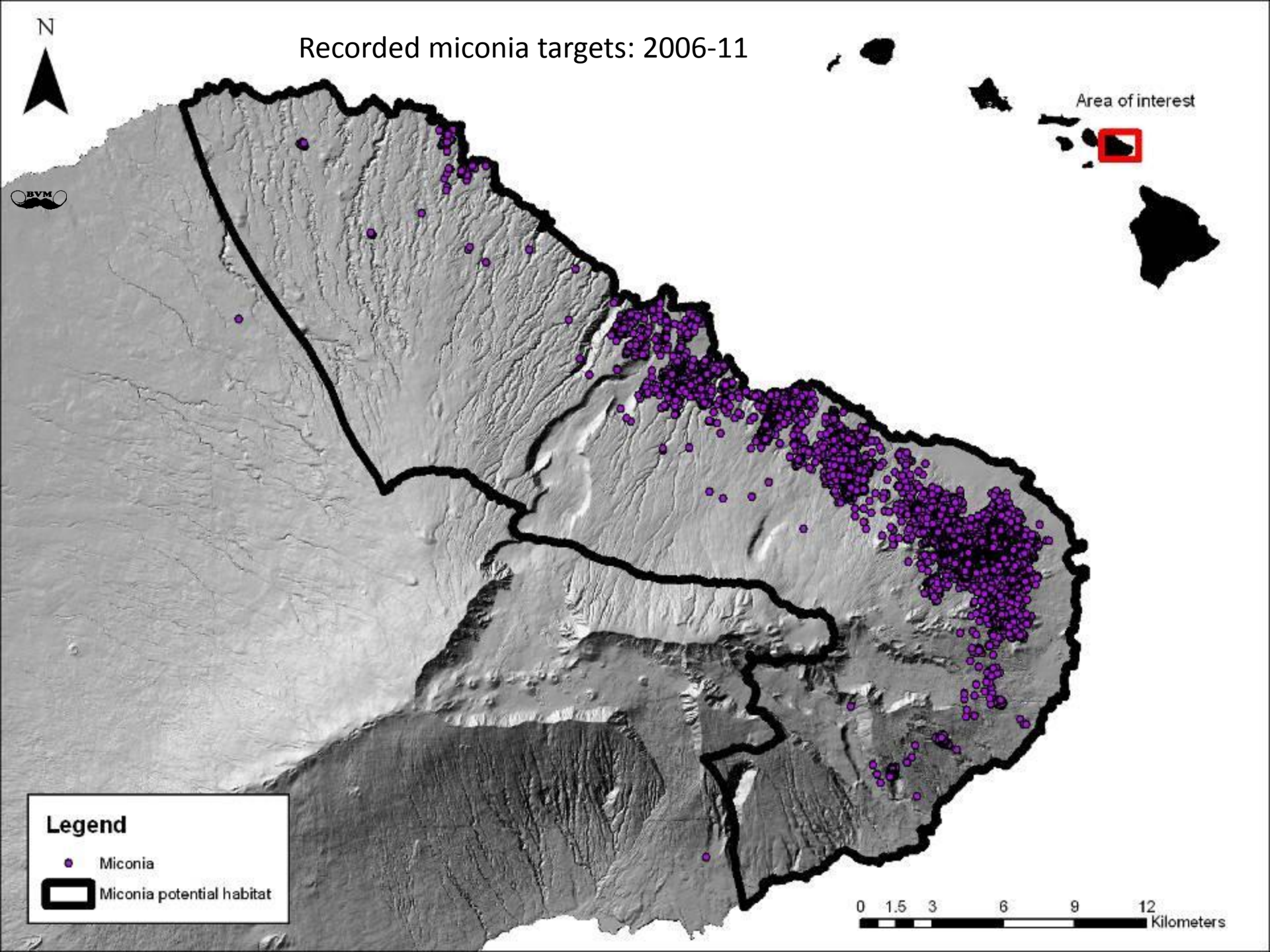


Area of interest

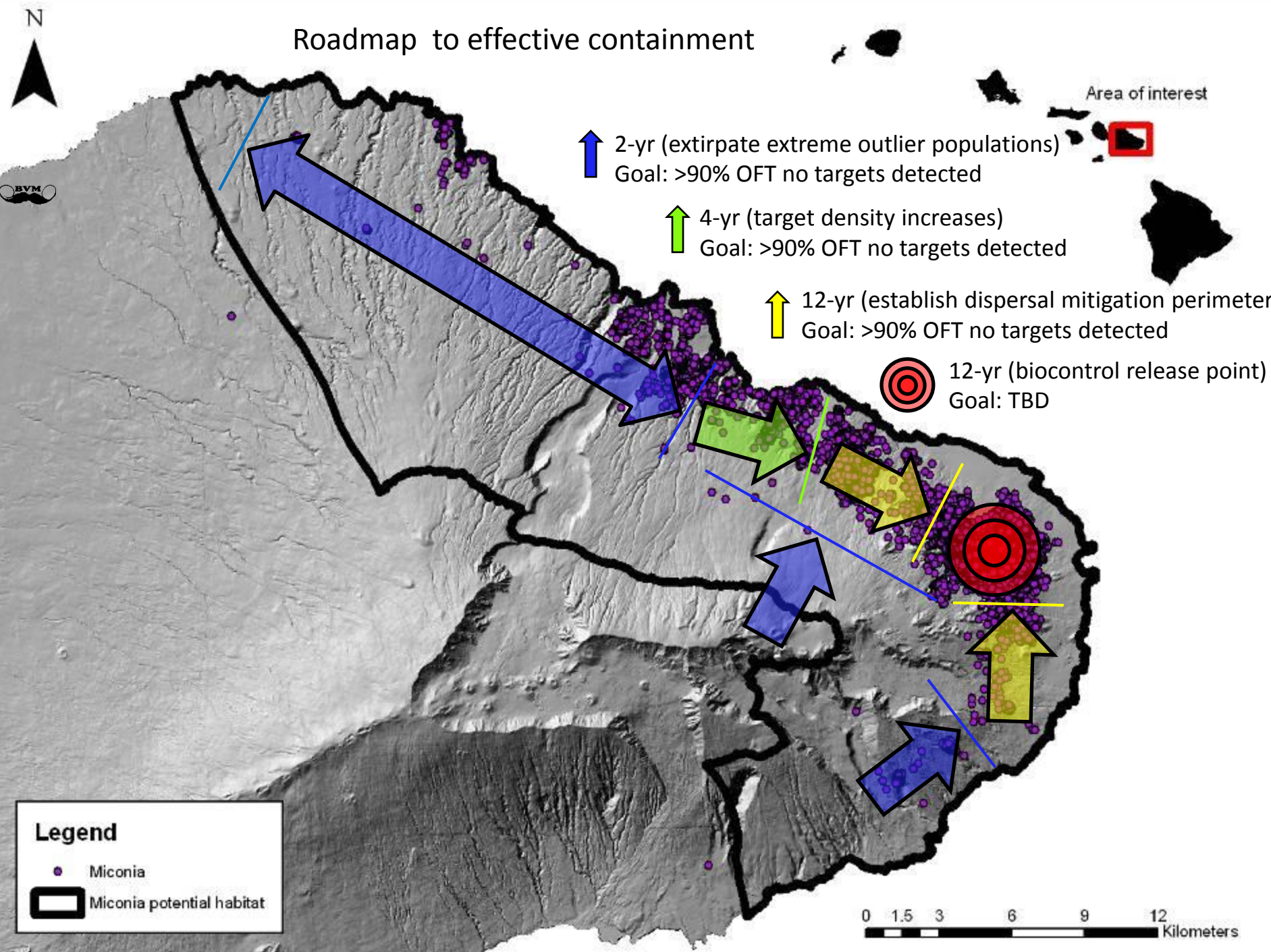



Legend

- Miconia
- ▭ Miconia potential habitat



Roadmap to effective containment





Collaborators:

James Leary, University of Hawaii at Manoa

Jeremy Gooding, National Park Service

Brooke Mahnken, Maui Invasive Species Committee

Adam Radford, Maui Invasive Species Committee

John Chapman, Kauai Invasive Species Committee

Guy Kyser, University of California at Davis

John Knapp, Native Range Inc.

Colleen Cory, The Nature Conservancy

Support provided by :

USFS Special Technology Development Program R5-2012-01



UNIVERSITY *of* HAWAI'I®

MĀNOA

James Leary

Assistant Specialist for Invasive Weed Management

Department of Natural Resources and Environmental Management

Maui County Cooperative Extension Service

College of Tropical Agriculture and Human Resources

University of Hawaii at Manoa

phone: 808-352-8774

email: leary@hawaii.edu

web: <http://www.ctahr.hawaii.edu/LearyJ/index.html>