Reducing the Nascent Patch Network of Miconia (*Miconia calvescens* DC) with an Accelerated Intervention Strategy Utilizing Herbicide Ballistic Technology (HBT)

For video rendition please visit: [http://www.youtube.com/watch?v=988i6SQKSzY](http://www.youtube.com/watch?v=988i6SQKSzY)
Invasion Biology of Miconia

- Miconia (*Miconia calvoscens* DC)
- An autogamous (self-fertile) species
- Millions of seed produced by a single tree
- Small, edible fruit dispersed by birds
- Dispersal range >1000 m
- Seed bank viability >20 years
- Germination in heavy shade

- A SINGLE MICONIA PLANT CAN IMPACT >1000 HA OF PROTECTED WATERSHED!


East Maui Watershed
>55,000 ha with 59 threatened and endangered species
Produces >200 billion liters of surface water each year
Multi-agency management initiated in 1991
Mission: Conduct interventions on high-value satellite target populations

Crew: Portside pilot/applicator + front starboard navigator creating a 220° FOV

Treatment: 0.68 caliber soft gel projectiles encapsulating 199.4 mg triclopyr (HBT-G4U200)
Accelerating deployment of HBT surveillance operations in 2012-2013
~237 hours of total flight time
Accelerating deployment of HBT surveillance operations in 2012-2013
~186 hours Operational Flight Time (OFT: airspeed \leq 20\ knots) covering \sim 3900\ ha (9600\ acres)
Accelerating deployment of HBT surveillance operations in 2012-2013
7463 targets treated with 194,026 projectiles w/ HBT; 33% increase in ops resulting in 168% increase in targets treated
A surgical herbicide delivery technique = small footprint on the landscape

Mean herbicide dose is 5.42 grams $ae^{-1}$ = 28 projectiles target$^{-1}$

89% of total net treated area (~530 ha) = <1% of max herbicide use rate ($HUR_{\text{max}}$; 6.72 kg $ae^{-1}/ha$)

$y = 5.4272x$
$R^2 = 0.914$

67.2 g $ae^{-1}/ha$ = 1% of $HUR_{\text{max}}$
Search efficiency of an HBT surveillance operation

\[ y = 0.897x + 0.6815 \]

\[ R^2 = 0.5309 \]

48% of total net area (~1850 ha) searched with only 4% OFT
Target density reduction fits exponential decay function
1% decay rate with 60% target density reduction; reduction half-life = 64 hrs OFT
Delimiting process expanding search area beyond known target locations
Operational performance improves with accelerated schedule
Herbicide use rate (grams acid equivalent) reduced 92.5%
Search efficiency improved by 68%
Reducing variable cost of operations

$$\text{ops} = TD * [(SE \times \text{OFT (heli = $16.68/min; 3-person crew = $1.22/min )} + (\text{PTE} \times ($0.31/\text{projectile})))$$

Variable costs of operation reduced 70%; **Protecting watershed at < $10/acre!!!**
Projecting future goals
2012-2013 achievements: 60% target density reduction; protected 3900ha
2014 goals: target density reduction >95%; expand protection >4100 ha
Custom HBT sensor data logger system
Improving spatial resolution (10m pixel res) of herbicide use rate

Dose rate (grams ae/tgt) for 142 TGTs

composite avg: 18.6 g
mean ± SD: 17.5 ± 12.6
Partners and Sponsors

This project is a partnership of the following programs:
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College of Tropical Agriculture and Human Resources

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