Axis Deer Early Detection and Research on Hawaii and Maui

Organization: The Big Island Invasive Species Committee, on behalf of the Big Island Axis Deer Working Group and Maui Deer Working Group.

Award: $91,464 (including restored funds)

Introduction: The mission of the Big Island Deer Working Group (BIDWG) is to ensure that Axis Deer and new, harmful exotic game never become established on the Big Island. BIISC has managed an Axis Deer response effort on behalf of the BIDWG since 2011. BIISC staff have successfully dispatched every confirmed deer sighting on the island (4) by May 2013, and have surveyed most of the island by helicopter, FLIR surveys, and on foot.

In 2016 BIISC and MISC combined limited resources to continue to employ two full time wildlife biologists to study the Axis Deer population on Maui, develop recommendations for improved management practices on Maui, and confirm the successful removal of the Axis Deer on the Big Island. Additional duties, including assisting state ungulate removal projects and responding to rabbit sightings were included in the deliverables for this award.

Achievements in FY16

Maui Project Deliverables

Deliverable 1: Refine population estimate for axis deer on Maui: 8.5 hours of aerial flights were conducted over 62,690.5 acres in June, 2016, just after fawning. Flights surveyed the Axis Deer Core Area, which includes the slope of Haleakala and saddle area between Kula, Ulupalekua, and Kihei (Figure 1), East Side of W. Maui Mountains, facing the Core (Figure 1), and the Western side of W. Maui Mountains (Figure 1). Counts of observed deer were used to derive population estimates using the program Distance, which provides a low, medium, and high density estimate (Table 1) based on assumptions about deer movement and detectability. The high-end estimate assumes that vegetation or terrain cause the observer to miss groups of deer similar to those observed. Due to the relatively open terrain, and ease of observation of infrequent, large groups of deer, it was concluded that the high-end model overestimated the numbers of deer, and was not a good match for this habitat. The medium-density estimate appears correct for the core and the Eastern slope. No deer were detected on the Western side of W. Maui Mts., although deer have been observed on the ground in recent years. It is recommended that aerial surveys be repeated at least once every five years to monitor the development of this population. A section of land at the Southern tip of the island was surveyed in 2013, but not in 2015 or 16, creating some uncertainty. Taking into consideration the unsurveyed areas, and variation in the model, we estimate that the deer on Maui number between 6,000 and 10,000 at the peak, post-fawning season, with some attrition each fall. A more detailed report is attached.

Table 1: 2016 Axis Deer population estimates after fawning.

Site	**Low Density**		**Medium Density**		**High Density***	
	Deer/km^2	**Est. pop.**	**Deer/km^2**	**Est. pop.**	**Deer/km^2**	Est. pop.
Core Area (300 km2)	13.3	3,992	**19.0**	**5,706**	27.2	8,156
Eastern Slope W. Maui (27.5 km^2)	4.6	127	**16.4**	**451**	58	1597
Western Slope W. Maui	0	0	**0**	**0**	0	0

*High Density Estimates are believed to be over-estimates. The Medium Density appears to match other observations.

Table 2: Axis Deer population estimates in the Core Area over three years.

Core Area (300 km2)	**Low Density**		**Medium Density**		**High Density***	
Year	**Deer/km^2**	**Est. pop.**	**Deer/km^2**	**Est. pop.**	**Deer/km^2**	Est. pop.
2013**	9.9	4,673	**14.8**	**7,009**	21.7	10,281
2015	9.5	2,848	**14.1**	**4,224**	20.9	6,266
2016	13.3	3,992	**19.0**	**5,706**	27.2	8,156

**2013 survey covered a larger area, including the southern tip of Maui, absent from 2015, 16 surveys.

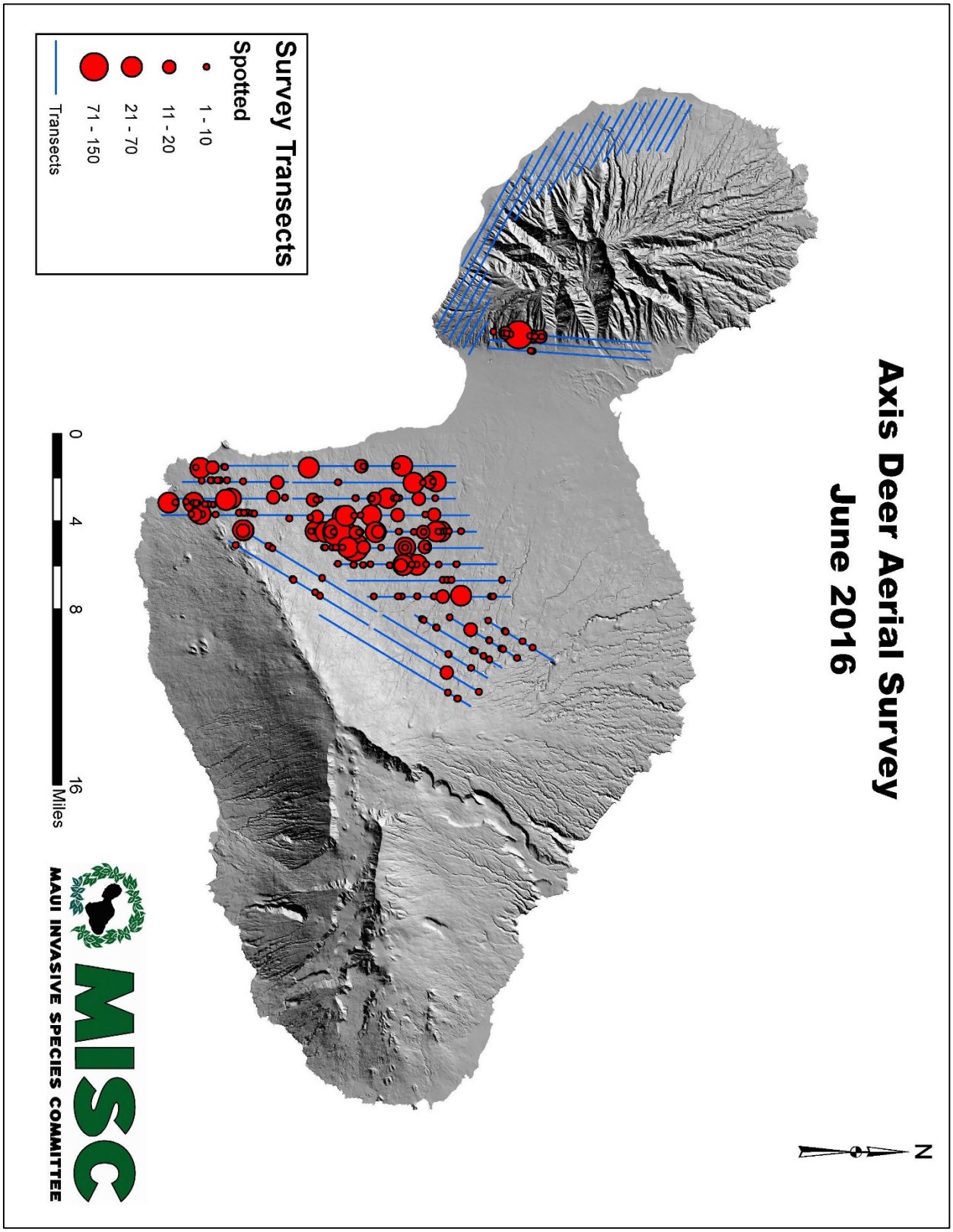

Figure 1: Aerial Surveys to estimate Axis Deer populations on Maui

Deliverable 2: Development and dissemination of information about possible control options and stakeholder engagement: BIISC Staff traveled to Maui and met with stakeholders including ranchers and conservation managers to develop strategies and methods for reducing deer damage to agricultural, ranch, and wild lands. Deterrence, fencing, and contraceptive methods were discussed at length, along with changes to management of populations and habitat in GMAs and support for the deer harvest cooperative. These conversations gained little traction, though there was a great deal of interest in collecting better information on the numbers, density, and movement of axis deer to assist recreational hunters.

Deliverable 3: Acres covered (aerial surveys): BIISC surveyed 62,690 acres over a 4 days in late June.

Deliverable 4: Number of events and people reached: Records of individual stakeholder meetings were not kept. As no consensus on management strategy was reached among stakeholders, no outreach events were held.

Big Island Project Deliverables

Deliverable 1: Response to reported sightings of axis deer and immediate suppression of deer: Five actionable deer sightings were reported in five locations around the island. An actionable report is one that is timely and specific, and includes contact information. Non-actionable reports are more frequent, and include references to "someone" who said they saw a deer "somewhere" some time ago—but they don't want to say who. Staff responded to each actionable report within 48 hours with in-person interviews, site surveys, and game camera and/or FLIR surveillance, approximately two full weeks of effort per report. Non-target species were confirmed at the site of each reported deer sighting, e.g. mouflon sheep, goats. No deer were detected as a result of reports in 2016.

Deliverable 2: Deployment of game cameras in high risk areas: Game camera grids consisting of up to 22 Reconyx game cameras were deployed in six high-risk areas to confirm absence of Axis Deer (Figure 2). Cameras were spaced 200 m to 400 m apart, depending on vegetation and terrain, ensuring complete coverage of the estimated Axis Deer home range. Cameras were placed in sites with frequent deer reports and in sites previously occupied by Axis Deer. No Axis Deer were detected during _5,064_ camera hours on 3,323.1 acres.

Deliverable 3: Area surveyed: BIISC staff surveyed 49,625.5 acres (FLIR-assisted ground surveys), spending 833 hours in the field. An additional 3,323.1 acres were surveyed using the camera grid method, totaling 52,948.6 acres surveyed. In addition, the network of existing camera grids in conservation areas proved to be a valuable tool for ruling out presence of deer.

Deliverable 4: Quarterly and annual written reports: Provided here.

Deliverable 5: Regular communication with BIDWG and DOFAW on sightings and field response efforts: Constant communication was maintained with BIDWG and DOFAW throughout year and regular BIDWG meetings were held for updates, reports, and project aid.

Deliverable 6: Summary report after each field response: BIISC maintained contact with chair of BIDWG, meeting regularly to update and discuss deer response outcomes/findings.

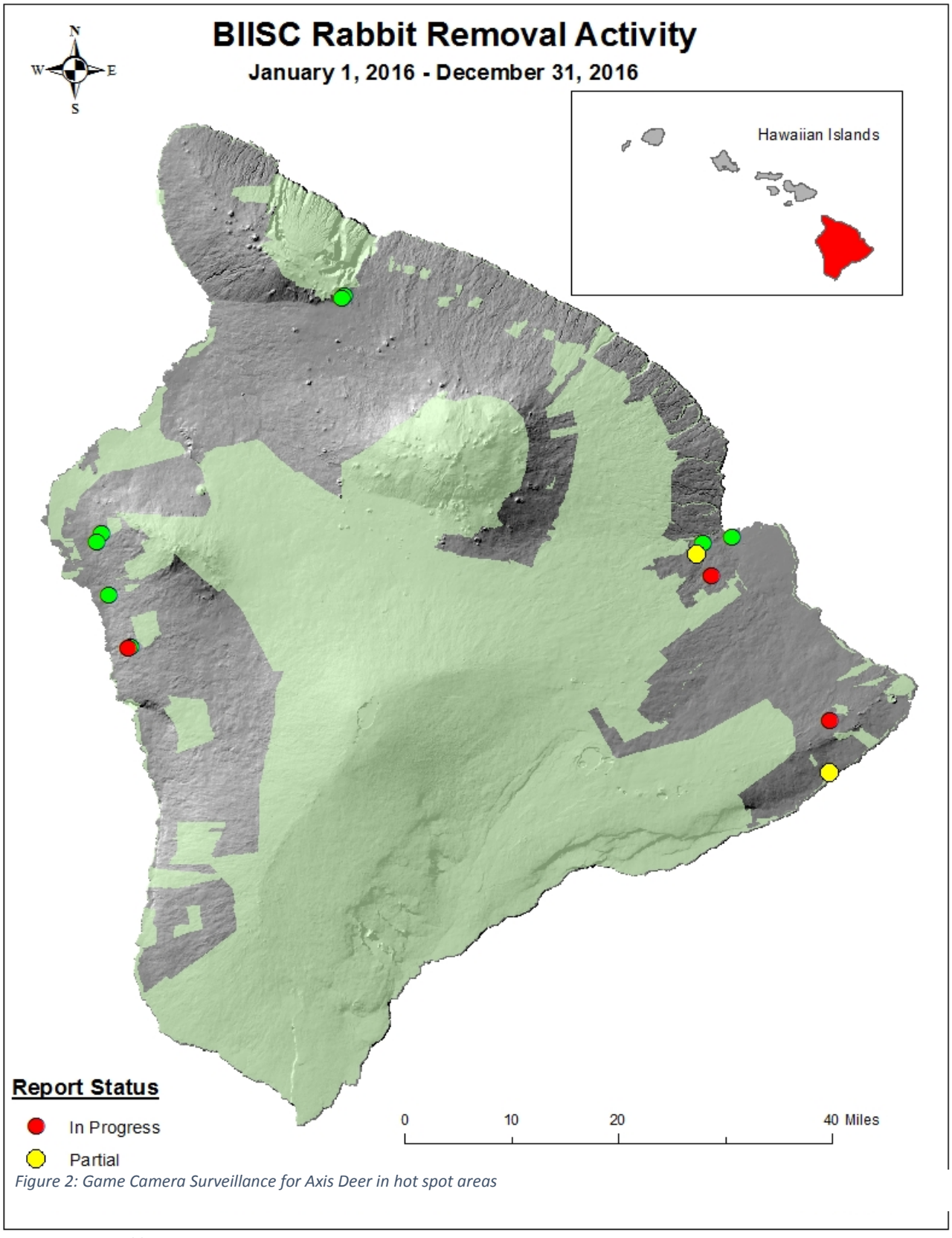

Figure 2: Game Camera Surveillance for Axis Deer in hot spot areas

Figure 3: BIISC Rabbit response activity in 2016

Other Activities in FY16

Other vertebrates: The vertebrate team surveyed 1,299.3 acres in response to dozens of Rabbit reports across the island. In August 2016, the Hawaii Tribune Herald ran an article about BIISC and the recent rabbit reports received. After that, dozens of additional reports came in of rabbits being found around the entire island. A total of 16 Rabbits were removed from 12 different locations (Figure 3) with actionable reports. Although breeding does were removed, no significant established populations were observed. Reports of a single well-established population remain unconfirmed on private ranch land.

In addition, BIISC aided TNC staff using FLIR and telemetry methods to track and dispatch Judas sheep from Kona Hema Preserve. BIISC staff surveyed 5,393 acres in one day and dispatched the sheep.

Palamanui Preserve: In August BIISC coordinated a large scale drive to push several goats out of the Palamanui Preserve which is an endangered plant critical habitat in which the goats were doing extensive damage. DOFAW, MKFRP, NPS, and HFIA assisted BIISC. All but one goat was pushed out, the remaining goat was removed the following month by the crew who manage the site.

Camera Grids: In addition to surveying high risk deer sites, BIISC assisted TNC and DOFAW in setting up camera grids in preserves to establish population estimates for other feral ungulates while also confirming absence/presence of axis deer. The information gathered helped TNC locate a remaining population of pigs in their fenced Makaalia unit (Three Mountain Alliance Watershed Partnership). The vertebrate team helped DOFAW create a baseline population of ungulates found in the Henahena Unit at PuuWaaWaa which is currently being fenced and develop a camera trapping plan to confirm if all ungulates have been removed from unit following fence completion. The network of existing camera grids used by conservation partners was invaluable in assessing the risk of axis deer throughout the past two years.

Recommendations

Axis Deer:

Funds are available for the BIDWG (BIISC) to continue monitoring through April, 2017, completing one full year of intermittent surveillance in hot spot areas. In the remaining months, we expect to complete an additional 1300 acres and 2,000 hours of game camera surveillance. We believe this will adequately and successfully conclude the brief Axis Deer episode on the Big Island.

We strongly recommend the allocation of resources to support ongoing random surveillance across the Big Island, as is done for new invasive plants. A strong step forward can be accomplished though routine use of game cameras by land-management agencies and large landowners, for example watershed partnership members. These land-managing agencies have a stake in routine monitoring of numbers and impacts of existing ungulate populations, and strong relationships with regulatory and response agencies like HDOA and DOFAW, who are the best choice to mount a response when a new species or impact is detected. We recommend staffing each of these agencies with a wildlife biologist specifically tasked to respond to illegally introduced and emerging nuisance populations of animals, and routine funding for the watershed partnerships to accomplish these goals. In lieu of that, BIISC would require additional funding in 2017 to continue staffing a wildlife biologist to cover those responsibilities.

Rabbits:

Response to rabbit reports is ongoing. If left unchecked, rabbits may cause significant agricultural damage to farms and gardens. The absence of established populations appears to be related to predation by house cats, mongoose, and dogs in high density neighborhoods. By contrast, the single

reported occurrence of an established population on ranch land, and the previously dispatched population on state land in West Hawaii, are examples of how that scenario might change in areas with a lower density of feral predators. Typical reports have led to capture of one to three naïve, escaped pet rabbits, with only a few instances of successful breeding. The likelihood of establishing a thriving warren on the island increases with each successful generation of wild-borne rabbits that no longer rely on human care.

The HDOA provided valuable back-up on response to homeowners, who, for the most part understood the risk of a burgeoning rabbit population. 14 rabbits were captured and turned over to either the Humane Society or a local rabbit ranch where they will be bred for meat. Two were dispatched with a gun. An informational pamphlet was provided to the Humane Society describing state law and adequate housing for rabbits, and which will be provided to all adopters of rabbits.

Other Vertebrates:

While there are active surveys for new invasive plants, we know of no ongoing, proactive surveys for new invasive birds, reptiles, and mammals outside of conservation managed lands. Response to reports of new invasive animals or increasing nuisance populations are often delayed due to lack of clear area of responsibility or lack of response capacity. The increasing numbers of rose-ringed parakeets in South Kona, which threatens the tropical fruit industry; steady reports of bulbul, birds which disperse miconia and other invasive plants long distances; and increasing frustration of West Hawaii residents dealing with emerging coqui populations are examples which--along with the completed Axis Deer response and ongoing rabbit response—support the argument for increased vertebrate response and control capacity at our state agencies and among our conservation partners.