Evaluation of Electric Fencing to Inhibit Feral Pig Movements

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ABSTRACT Natural resource managers and agricultural producers are seeking innovative tools to minimize damages caused by rapidly expanding feral pig (*Sus scrofa*) populations. One tool that has received little scientific inquiry is the use of exclusion fences to protect economically and ecologically sensitive areas. Our objectives were to evaluate the ability of electric fencing to minimize feral pig movements in a captive setting as well as in rangeland and agriculture land. In captivity, we tested a 1-, 2-, and 3-strand electric fence. In our captive trial, we found 65% fewer intrusions ($F_{2,18} = 20.46$, $P < 0.001$) for electric fences ($\bar{x} = 12.4$, SE = 2.8) compared with nonelectric fences ($\bar{x} = 35.6$, SE = 6.9). We found no difference ($F_{2,9} = 1.85$, $P = 0.212$) for 1-strand ($\bar{x} = 28.1$, SE = 7.8), 2-strand ($\bar{x} = 14.2$, SE = 3.2), and 3-strand ($\bar{x} = 16.9$, SE = 4.3) electric fences. However, we found 50% and 40% fewer crossings for the 2- and 3-strand fences, respectively, compared with the 1-strand fence. In our rangeland trial, we found 49% fewer intrusions ($F_{2,18} = 4.39$, $P = 0.028$) into bait stations with a 2-strand electric fence ($\bar{x} = 4.1$, SE = 1.8) compared with no fence ($\bar{x} = 8.1$, SE = 2.4). Finally, in our agriculture trial, we found 64% less damage ($\chi^2_2 = 5.77$, $P = 0.016$) to sorghum crops with a 2-strand electric fence ($\bar{x} = 4.48$, SE = 0.01%) compared with no electric fence ($\bar{x} = 12.46$, SE = 0.03%). Furthermore we found no ($\chi^2_1 = 3.72$, $P = 0.054$) wildlife pathways in areas with an electric fence ($\bar{x} = 0.0$, SE = 0.0) compared with no fence ($\bar{x} = 2.4$, SE = 1.3). No electric fence design we tested was 100% pig-proof. However, we found electric fencing restricted feral pig movements. Combining electric fencing with other damage control methods in an integrated management program may be the best method for alleviating feral pig damages. (JOURNAL OF WILDLIFE MANAGEMENT 72(4):1012–1018; 2008)

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Feral pigs (*Sus scrofa*) are an introduced ungulate consisting of formerly domesticated pigs, Eurasian wild boar, and their hybrids (Sweeney et al. 2003). In the United States, feral pigs are invasive and are implicated in economic and environmental damages, including consumption of crops, disease transmission, increased soil erosion, destruction of habitat, competition with native wildlife, and predation of livestock, ground-nesting birds, reptiles, and amphibians (Mayer and Brisbin 1991, Gipson et al. 1998). Feral pigs cause approximately $800 million in damages to livestock producers, farmers, and wildlife managers in the United States each year (Pimental et al. 2005). Furthermore, feral pigs have high productivity compared with other wild ungulates (Taylor et al. 1998), can withstand intensive harvest (Giles 1980), and are capable of overpopulating an area in a short time (Barrett and Birmingham 1994). Feral pigs are too prolific and elusive to be totally eliminated in most areas (Bach and Connor 1997), and agricultural and environmental damage will continue to increase as feral pigs flourish (Seward et al. 2004).

Natural resource managers and agricultural producers are seeking innovative tools to minimize damages caused by rapidly expanding feral pig populations. One tool that has received little scientific inquiry is the use of exclusion fences for protecting economically and ecologically sensitive areas, endangered species, and livestock from feral pigs. In one of the few scientific articles involving exclusion fences for feral pigs, Hone and Atkinson (1983) evaluated 8 fence designs in New South Wales, Australia. Experimental fence designs included net wire and electric fencing with galvanized steel wire. Hone and Atkinson (1983) found net-wire fencing to be the only pig-proof fence and, additionally, found electric fencing to be capable of greatly limiting, but not wholly preventing, feral pig movement. The Hone and Atkinson (1983) research occurred exclusively in captivity, so inferences to free-range environments are constrained. In the United States, electric fencing has been proven effective for other free-ranging wildlife. For example, electric fencing has effectively excluded or inhibited movements of coyotes (*Canis latrans*; Gates et al. 1978), white-tailed deer (*Odocoileus virginianus*; Miller et al. 1992, VerCauteren et al. 2006*a*), black bears (*Ursus americanus*; Falker and Brittingham 1998), elk (*Cervus canadensis*; Schmidt and Knight 2000), badgers (*Meles meles*; Poole et al. 2004), and bison (*Bison bison*; Karhu and Anderson 2006).

Given the extent of damage caused by burgeoning feral pig populations and the effectiveness of electric fencing for other wildlife, we believe additional study into electric fencing to inhibit feral pig movements is prudent. Furthermore, no research has been conducted on polywire electric fencing for feral pigs. Polywire fencing is more flexible than traditional steel wire fencing and can be removed and reused. Our objectives were to evaluate the efficacy of electric fencing to inhibit feral pig movements in captivity with wild-caught feral pigs, on rangeland with free-ranging feral pigs, and on agriculture land with free-ranging feral pigs.

STUDY AREA

We conducted captive feral pig research at the Texas A&M University–Kingsville (TAMUK) Captive Wildlife

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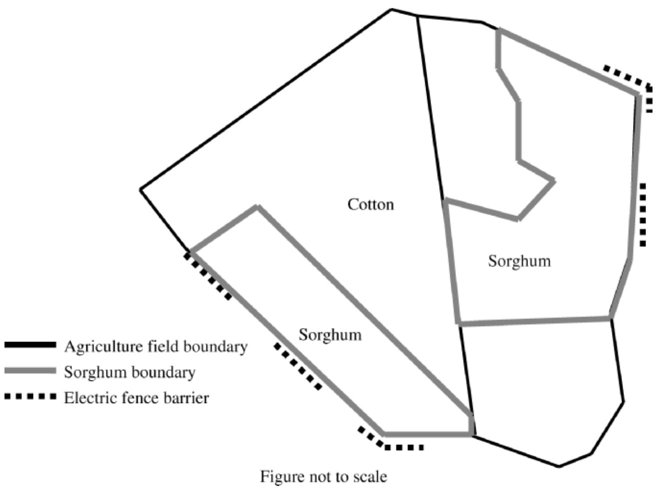

Figure 1. Agriculture fields, planted sorghum and cotton crops, and established electric fence barriers for feral pigs and other mammals at the Laureles Divison of the King Ranch from 18 May 2006 to 30 June 2006.

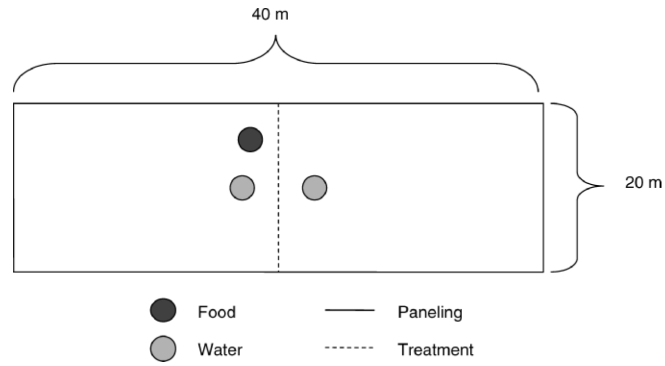

Figure 2. Electric fence enclosures for captive feral pig trials at the Texas A&M University–Kingsville Wildlife Research Facility from 12 October 2005 to 2 November 2005.

Research Facility located 5 km south of Kingsville in Kleberg County, Texas, USA (27°27′N, 97°53′W). We used 3 0.17-ha pig-proof pens constructed of 2.5-m-high fence attached to a central building where pigs could be handled. We built trial pens adjacent to these holding pens (described below). Pens contained native vegetation, such as honey mesquite (*Prosopis glandulosa*), spiny hackberry (*Celtis pallida*), and lime pricklyash (*Zanthoxylum fagara*).

We conducted free-ranging feral pig electric fence evaluations at the Rob and Bessie Welder Wildlife Refuge (WWR), 12.8 km north of Sinton in San Patricio County, Texas (28°06′N, 97°22′W). The refuge consisted of 3,157 ha, bordered to the north by the Aransas River, on the west by United States Highway 77, and on the south and east by private rangeland. Habitat was characteristic of both the Gulf Prairies and Marshes and South Texas Plains ecoregions (Drawe et al. 1978). Overstory vegetation consisted of huisache (*Acacia farnesiana*), honey mesquite, and live oak (*Quercus virginiana*). Limited hunting and no supplemental feeding of wildlife occurred on the property.

We conducted agriculture-land electric fence research at the Laureles division of the King Ranch on contiguous agriculture fields totaling 2,435 ha of dryland (nonirrigated) farmland (27°23′N, 97°36′W). In March 2006, King Ranch farmers planted approximately 554 ha on the north side and 394 ha on the south side of the field in sorghum (*Sorghum bicolor*), and the rest of the acreage in cotton (*Gossypium* sp.; Fig. 1). These fields were surrounded by semiarid rangeland typical of southern Texas, dominated by honey mesquite and huisache.

METHODS

For our captive trial, we captured 18 feral pigs ranging from 12 kg to 46 kg on private land near Kingsville, Texas, from 20 September 2005 to 5 October 2005. We used box-style, trip-wire traps baited with soured corn. We removed feral pigs from traps using noose-style catch poles. We placed a plastic ear tag (Allflex, Dallas Fort Worth Airport, TX) with a unique identification number in the left ear of each animal, isolated captured animals in a darkened trailer, and transported them to the captive facility. We randomly separated feral pigs into 3 groups and placed each group in a separate holding pen. We provided feral pigs with free access to water and food and allowed them to acclimate to captivity for 10–22 days. All capture and handling procedures were approved by the Institutional Animal Care and Use Committee at TAMUK (no. 2004-06-18).

For our experimental fences we used Speedrite (Tru-Test, Mineral Wells, TX) Delta 1B solar chargers and Speedrite ultrawire polywire fencing attached to metal T-posts by plastic insulators. Our polywire was approximately 3 mm in diameter and consisted of ultraviolet, stabilized polyethylene yarn braided with tin plated copper wire as the conductor. We electrified all strands of each fence and found a mean daily voltage of 8.5 kilovolts (kV) for all replicates.

We compared 3 fence treatments. Our first treatment consisted of one strand of polywire at 20 cm above the ground. Our second treatment consisted of 2 strands of polywire at 20 cm and 45 cm above the ground. Our third treatment consisted of 3 strands of polywire at 20 cm, 45 cm, and 71 cm above the ground. We constructed 3 20 $\times$ 40-m trial enclosures adjacent to the holding pens at the captive research facility (Fig. 2). Trial enclosures were protected on 3 sides by a 2.5-m-high fence (described above) and on the final side by 1.2-m-high, 10 $\times$ 10-cm welded steel paneling. Furthermore, we bisected each trial enclosure with an electric fence treatment. We provided water on both sides of the treatment fence.

We conducted our trial from 12 October 2005 to 2 November 2005. For each replicate, we placed one feral pig into a trial enclosure for 72 hours. The first 24-hour period was the control, in which the electric fence was not electrified. The second 24-hour period was the test, in which the electric fence was electrified. The third 24-hour period was the memory test, in which the electric fence was again not electrified. Furthermore, to minimize bias associated with the different enclosure orientations and vegetation composition, we alternated treatment fences within enclosures such that each treatment fence was deployed twice within each enclosure. We used each feral pig once for a total of 6 pigs per treatment. At the beginning of all 3 periods, we placed 2 kg of soured corn on the side opposite (relative to the treatment fence) of the feral pig. We used Silent Image™

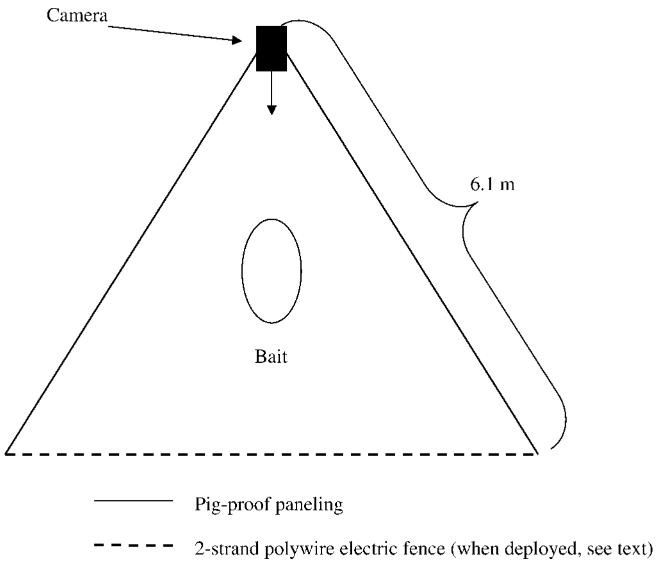

Figure 3. Feral pig bait stations established at the Rob and Bessie Welder Wildlife Refuge near Sinton, Texas, from 28 February 2006 to 11 April 2006.

(RECONYX, LaCrosse, WI) motion-sensing continuous video cameras to record the number of treatment-fence crosses by feral pigs during each 24-hour period.

Rangeland Trial

We established 8 bait stations on the WWR on 28 February 2006 and an additional 2 stations on 4 March 2006. We placed bait stations $\geq$1 km apart in areas where we observed abundant feral pig sign. Each bait station consisted of 2 1.2 $\times$ 6.1-m, welded-wire panels with a 10 $\times$ 10-cm mesh placed in a wedge configuration (Fig. 3). The third side consisted of an electric fence when deployed (see below). We placed 6 kg of soured corn daily in the center of each bait station throughout the trial. We monitored each bait station with a Silent Image motion-sensing continuous video camera.

We used a 2-strand electric fence at 20 cm and 45 cm above the ground for our rangeland trial because we observed most feral pigs crossing over rather than under the 1-strand fence in our captive trial. We used Gallagher B75 battery powered chargers (Gallagher Animal Management Systems, North Kansas City, MO) and Speedrite Delta 1B solar chargers to power the fences. Furthermore, we used Speedrite ultrawire polywire fencing attached to metal T-posts by plastic insulators to carry the electric current. We electrified all strands of fence and found a mean daily voltage of 7.2 kV.

We evaluated the effectiveness of the electric fence at our 10 bait stations over 3 time periods. During our first period, 1–14 March 2006, no electric fence was deployed. During our second period, 15–29 March 2006, we deployed our 2-strand polywire electric fence to enclose the wedge, and we electrified it. During our third period, 29 March 2006 to 11 April 2006, we maintained the electric fence; however, it was not electrified. We recorded species, time, group size, and estimated age (juv or ad) of animals visiting and intruding into bait stations from camera observations.

Agriculture Trial

We evaluated the efficacy of electric fence to reduce damage to fields planted in sorghum. We established an electric fence treatment and a control treatment (each with 5 replications) along the border of the sorghum crop within the agriculture field (Fig. 1). Our electric fence treatment consisted of 600 m of 2-strand polywire electric fencing at 20 cm and 45 cm from the ground, parallel and approximately 0.5 m away from the edge of the agriculture field. We used Gallagher turbowire, a 3-mm-thick, ultraviolet, stabilized polyethylene yarn braided with tin-plated copper wire as the conductor, as the fencing material. We used Speedrite Delta 1B solar-powered energizers and Gallagher B75 battery-powered energizers to provide electricity. We anchored the fences at each corner and every 100 m with metal T-posts and plastic insulators. We further used plastic fence posts every 30 m to maintain fences at the desired height. We electrified all strands of fence and found a mean daily voltage of 7.7 kV. We constructed fences on 19 May 2006 and ensured their proper functioning every 3 days throughout the trial. Our control treatment was identical and adjacent to the electric fence but contained no electric fence barrier.

We established a 25-m perpendicular transect toward the interior of the field every 50 m along the sorghum field boundaries. We used a 1-m^2 frame to sample vegetation plots on each transect at 1 m, 5 m, 10 m, 15 m, 20 m, and 25 m for a total of 720 plots (72 plots/replicate). We quantified the number of viable and undamaged sorghum plants in each plot. We considered sorghum plants broken at the base or with terminal ends or seed heads removed or destroyed as damaged and unharvestable. We initially sampled plots before fence construction on 18 May 2006 and sampled those plots again on 29–30 June 2006 before harvest. We determined percentage of damage to the sorghum crop from these 2 sampling events. Furthermore, we quantified the number of wildlife pathways into the sorghum field for each replicate. We defined a wildlife pathway into the sorghum field as $\geq$0.5 m wide, $\geq$25 m long, and regularly used. We removed fences on 30 June 2006, and crops were harvested 7 July 2006.

Data Analyses

For our captive trial, we compared the effectiveness of treatment fences to reduce feral pig fence crossings with a 2-way factorial analysis of variance (ANOVA) with repeated measures (von Ende 2001, SAS Institute 2002). We considered the mean number of fence crossings per 24-hour period as our dependent variable. We determined statistical significance at $\alpha = 0.10$ to reduce the probability of Type II error, given our small sample size (Dowdy and Weardon 1991).

For our rangeland trial, we evaluated effectiveness of the 2-strand fence to reduce wildlife intrusions by comparing variables with a repeated-measures ANOVA (SAS Institute 2002). We considered mean number of intrusions by species and age class as the dependent variable and period ($n = 3$) as the independent variable. We determined statistical significance at $\alpha = 0.10$. We used Tukey's multiple-comparison test to determine differences among periods. Furthermore, we analyzed percentage of feral pigs observed in photographs

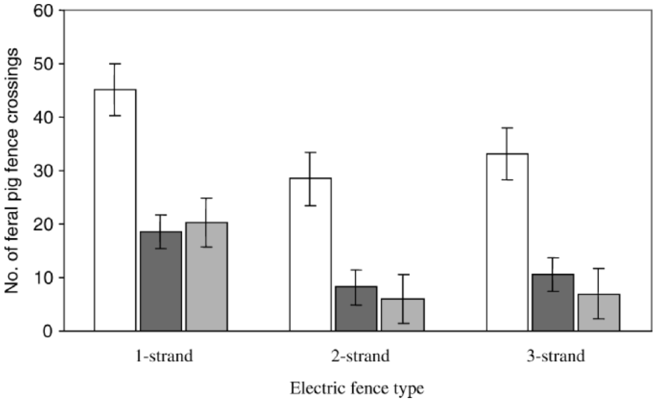

Figure 4. Mean (± SE) number of crossings by captive feral pigs across 1-, 2-, and 3-strand electric fences during 3 24-hour periods at the Texas A&M University–Kingsville Captive Wildlife Research Facility during the captive feral pig trial from 12 October 2005 to 2 November 2005.

that intruded into bait stations by period with the chi-square statistic and Yates correction (Alder and Roessler 1977). For this analysis, we considered percentage values of pig intrusions from period 1 as the expected value.

For our agriculture trial, we evaluated effectiveness of the 2-strand fence to reduce wildlife damage by comparing percentage of damage means between treatments with a Kruskal–Wallis rank-sum test (SAS Institute 2002). We considered treatment ($n = 5$ for each treatment) as the independent variable and percentage of damage as the dependent variable. We determined statistical significance at $\alpha = 0.10$. We also evaluated mean number of wildlife pathways between treatments using a Kruskal–Wallis rank-sum test with statistical significance determined at $\alpha = 0.10$. We considered treatment ($n = 5$ for each treatment) as the independent variable and the number of pathways as the dependent variable.

RESULTS

For our captive trial, we recorded 103,557 photographic observations of feral pig interactions with electric fence treatments. We found mean (± SE) number of crosses for period 1 (35.6 ± 6.9) were 65% greater ($F_{2,18} = 20.46$, $P < 0.001$) than for period 2 (12.4 ± 2.8) and 69% greater than for period 3 (11.1 ± 4.2; Fig. 4). Furthermore, we found mean (± SE) the number of crosses combining all periods, for 1-strand (28.1 ± 7.8), 2-strand (14.2 ± 3.2), and 3-strand (16.9 ± 4.3) electric fences, did not differ ($F_{2,9} = 1.85$, $P = 0.212$). However, we found 50% and 40% fewer crossings with the 2-strand and 3-strand polywire fences, respectively, compared with the 1-strand fence.

Rangeland Trial

We recorded 342,967 photographic observations of wildlife at bait stations during the rangeland trial. Species regularly using the bait stations included feral pigs, white-tailed deer, raccoons (*Procyon lotor*), and collared peccaries (*Tayassu tajacu*).

We found mean number of daily intrusions (Table 1) by all feral pigs during period 2 to be 49% less ($F_{2,18} = 4.39$, $P = 0.028$) than during period 1 and 26% less than during period 3. Adult feral pigs were more dramatically affected by presence of the electric fence than were juvenile pigs and piglets (Fig. 5), and mean number of daily intrusions by adult pigs during period 2 were 84% less ($F_{2,18} = 8.67$, $P < 0.001$) than during period 1 and 68% less than during period 3. Finally, we found percentage of pigs seen in photographs that intruded into bait stations during period 2 (25 ± 9%) and period 3 (87 ± 4%) to be lower ($\chi^2_2 = 72.6$, $P < 0.001$) than our expected value (100%) from period 1.

Mean number of daily intrusions for white-tailed deer during period 1 were 54% greater ($F_{2,18} = 8.76$, $P = 0.002$) than during period 2 and 46% greater than during period 3 (Table 1). However, for raccoons, we found mean number of daily intrusions to be 47% greater ($F_{2,18} = 8.30$, $P = 0.003$) during period 2 and 68% greater during period 3 than during period 1. Finally, we found no difference among periods in collared peccary mean daily intrusions ($F_{2,18} = 1.38$, $P = 0.277$).

Table 1. Mean (± SE) daily intrusions into bait stations ($n = 10$) by feral pigs and other mammals at the Rob and Bessie Welder Wildlife Refuge during rangeland electric fence trials, 28 February 2006 to 11 April 2006.

	Period[a]					
	1		2		3	
Species	$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE
Feral pigs (all)	8.1A	2.4	4.1B	1.8	5.5AB	5.5
Ad only	4.3A	1.0	0.7B	0.3	2.2AB	0.5
White-tailed deer	1.3A	0.3	0.6B	0.3	0.7B	0.3
Raccoons	1.0B	0.2	1.9AB	0.6	3.1A	0.6
Collared peccaries	0.7A	0.5	0.2A	0.2	0.2A	0.1

[a] Within a row, means with the same letter do not differ significantly ($P > 0.10$) using Tukey's multiple-comparison test.

Agriculture Trial

We found mean percentage (± SE) of sorghum crop damage at harvest for electric fence treatments (4.48 ± 0.01%) was 64% less ($\chi^2_1 = 5.77$, $P = 0.016$) than controls with no electric fence (12.46 ± 0.03%). Furthermore, we found mean number (± SE) of wildlife pathways at harvest for electric fence treatments (0.0 ± 0.0) were less ($\chi^2_1 = 3.72$, $P = 0.054$) than controls with no electric fence (2.4 ± 1.3).

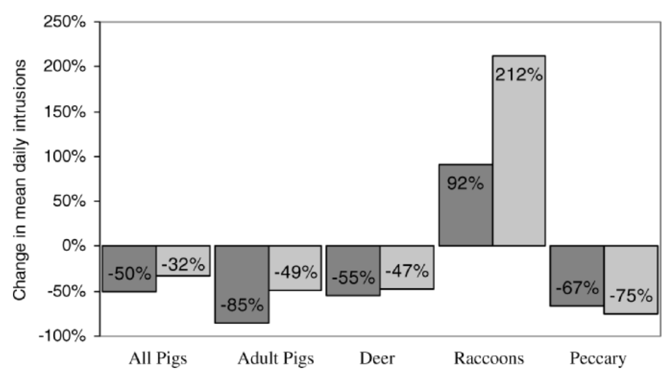

Figure 5. Change (%) in mean daily intrusions into bait stations ($n = 10$) by raccoons and large mammals from period 1 to period 2 and period 3 at the Rob and Bessie Welder Wildlife Refuge during the field electric fence trial, 28 February 2006 to 11 April 2006.

DISCUSSION

Tools most used by natural resource managers to control feral pig damages are lethal, including intensive harvest by recreational hunters, aerial harvest by helicopter, trapping, snaring, and poisoning (Littauer 1993, Geisser and Rayer 2004). The primary goal of feral pig control is to reduce damage in a cost-effective, humane, and socially acceptable manner (Caley 1999). However, in many situations, the above-mentioned approaches do not meet these criteria. For example, recreational hunting may not be applicable in urban areas and wildlife refuges. Furthermore, the effectiveness of recreational hunting to reduce feral pig damage has not been adequately studied (McIlroy 1995, Cowled and Lapidge 2004). Aerial harvest by helicopter is expensive, costing >$300/hour (Mapston 1999), and inclement weather and dense vegetation can limit success (Littauer 1993). Snares and traps require less manpower and are less expensive. However, nontarget species may also be caught, pigs may become trap shy or snare wary, and traps are cumbersome to move and reset (Littauer 1993, Mapston 1999). Finally, poisoning may be the most cost-effective and efficient control method available (Littauer 1993). However, no toxicants are registered for use on feral pigs in the United States (Littauer 1993, Mapston 1999). Furthermore, toxicants are a potential hazard to nontarget species, and a pig-specific delivery system has not been developed in the United States (Campbell et al. 2006).

Because of the above-mentioned complications, natural resource managers are experimenting with nonlethal control methods to reduce feral pig damages. One such method is the use of exclusion fences to reduce feral pig movements into economically and environmentally sensitive areas, such as threatened habitats, endangered sea turtle nesting grounds, agriculture fields, wildlife refuges, and urban areas (Seward et al. 2004). However, traditional pig-proof exclusion-fencing is expensive, costing $8,200–21,325/km and acts as a physical barrier that inhibits feral pigs because they are unable to break it, push through it, or dig under it (Polhemus 2003). Furthermore, traditional fencing is permanent and cannot easily be moved or removed.

Electric fencing, on the other hand, is a psychological rather than a physical barrier. Wildlife can physically push through this type of fence without damaging it or harming themselves. However, the psychological threat of electric shock often prohibits animals from crossing. Electric fencing has been used to contain and protect livestock and agriculture since the 1960s and was initially constructed with smooth steel wire (Cadwallader 1992). Electric fencing is inexpensive, costing approximately $2,000/km (Miller et al. 1992) and has been successfully used in the United States to reduce white-tailed deer damage (VerCauteren et al. 2006*a*) and to protect livestock from coyotes (Gates et al. 1978). However, steel-wire electric fencing is relatively permanent and cannot be moved or reused easily. Newer electric fence types are now available using polytapes and polywires consisting of conductive wires incorporated into synthetic ribbons or ropes (Seamans and VerCauteren 2006). Poole et al. (2004) found only marginal differences in the ability of polywire versus steel wire to inhibit badger movements in the United Kingdom. Polywire fence types have an advantage over steel wire in that they can be removed, moved, and reused easily and are economical for temporary and seasonal fencing. VerCauteren et al. (2006*b*) has developed a model for determining cost-effectiveness of different electric and nonelectric fence types.

Hone and Atkinson (1983) evaluated 8 electric fence designs for feral pigs in a captive setting. Pigs were found to cross all electric fence designs and were only fully excluded by 8 × 15-cm welded-wire mesh. However, the least-effective exclusion-fence design Hone and Atkinson (1983) tested, a 6-strand electric fence 85 cm high with one outrigger wire at 22 cm, was able to exclude 75% of feral pigs.

In our feral pig trials, electric fencing performed well. In our captive trial, we tested simple designs and found all feral pigs readily crossed the nonelectrified polywire fence. However, once we electrified the polywire fence, crossings substantially declined. Furthermore, for period 3, we removed electricity from the fence and found feral pigs continued to avoid the polywire fence.

In our rangeland trial, we found the 2-strand polywire electric fence reduced daily intrusions by 50% and excluded 75% of feral pigs that came to bait stations (Fig. 5), which included many juvenile pigs (<20 cm tall) that were small enough to slip under the 20-cm strand without receiving a shock. Adult feral pigs were more effectively deterred than juvenile pigs. Furthermore, for period 3, we removed electricity and feral pigs continued to avoid the fence. Our electric fence could be deployed with a bottom strand low enough to affect juvenile feral pigs. However, maintenance requirements (vegetation removal) with a wire <20 cm above the ground may be cost prohibitive in some areas. Therefore, depending on the level of exclusion or reduction in damage required, alterations to our design may be warranted.

Our 2-strand polywire electric fence also affected other species of wildlife during our rangeland trial. White-tailed deer were partially excluded by our polywire electric fence design even though they could jump over it. Raccoons were released by the presence of our polywire electric fence. Raccoons were able to slip under the electric fence without receiving a shock or climb the exclusion paneling to gain access to the bait stations. Finally, collared peccary visitations and intrusions into bait stations were low and sporadic, and we could make no meaningful conclusions about them.

Protection of agriculture fields from feral pigs and other marauding wildlife presents a difficult problem for land managers because agriculture fields usually encompass large areas, are seasonal resources, and require regular access by large equipment. Portable polywire electric fence may be ideally suited for protection of agriculture fields. Our agriculture trial tested the ability of polywire electric fence to protect a seasonally vulnerable agriculture field from feral pig and other wildlife damage in a real-world situation. We identified feral pig scat and tracks within the agriculture field and found several wallows adjacent to the field.

Furthermore, damage to the sorghum crop consisted of trampled or entirely removed sorghum plants with consumed seed heads. However, other wildlife species are capable of damaging agriculture crops. Therefore, we identified all agriculture damage as wildlife damage. We found our 2-strand polywire electric fence reduced damage compared with unprotected controls. Furthermore, we did not identify any wildlife pathways into the sorghum crop where the polywire electric fence was constructed. The majority of damage identified in control treatments was associated with wildlife pathways.

MANAGEMENT IMPLICATIONS

Electric fencing is a valuable tool for reducing feral pig damages that should be added to a land manager's repertoire. No electric fence design we tested was 100% pig-proof. However, electric fencing can significantly restrict feral pig movements. Therefore, combining electric fencing with other damage control methods in an integrated management program may be the best method for alleviating feral pig damages and controlling populations (Choquenot et al. 1996). However, efficacy of electric fencing to protect other economically and ecologically important areas, such as orchards, livestock, and wetland habitats, from feral pig damage needs scientific evaluation. Furthermore, long-term and multiseason evaluations of electric fence should be pursued. More study is needed on different electric fence designs and their integration into feral pig damage control programs.

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