AgriLIFE EXTENSION
Texas A&M System

Department of Wildlife and Fisheries Sciences

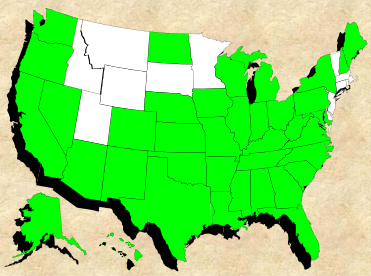
Jim Gallagher
Wildlife Specialist
Uvalde, Texas

Improving Lives. Improving Texas.

Population Dynamics and Distribution of Feral Hogs

FERAL HOG EXPANSION

- 1988—462 U.S. counties had feral hogs
- 2004—1,042 U.S. counties had feral hogs
- Increase of 125% !!!
- 39 states and 4 Canadian Provinces as of 2006



How Did We Get So Many So Fast?

- Generalist Ominivores
- Intelligent
- Indiscriminant stockings
- Supplementally Fed
- High reproductive rates

Fecundity (Reproductive potential)

- **Most prolific large, wild mammal in North America**
- **Early maturity**
- **Short gestation**
- **Large litters**
  - **"The average litter size may be 3 to 4 pigs, but 8 survive." - D. Whitehouse**

	Eurasian Wild Hog	Feral Hog	Domestic Hog
Sexual maturity	7-9 months (female) 10-15 months (male)	6-8 months (female) 9-12 months (male)	5-7 months (female) 8-10 months (male)
Gestation period	120-140 days	115-130 days	110-120 days
Weaning age	5-6 months	4-5 months	3-4 months
Litter size	4-6	5-8	10-12
Litters per year	1	1.5	2

SRNL
We Put Science To Work

Reproductive Biology of an Introduced Wild Pig Population over Four Decades

John J. Mayer and I. Lehr Brisbin, Jr.
Savannah River National Laboratory
Aiken, South Carolina (JJM)
and
Savannah River Ecology Laboratory
Aiken, South Carolina (ILB)

Wild Pig Reproductive Biology

Results – Female Parameters

A total of 2,483 sows examined:

- 712 (29%) were pregnant
- 348 (14%) were lactating
- 52 (7%) of the pregnant sows were also nursing a litter of piglets

17-year Hawaiian Study (Hess et al. 2006):

- Sample size = 327
- Pregnant – 77 (24%)
- Lactating – 34 (10%)
- Both – 2 (1%)

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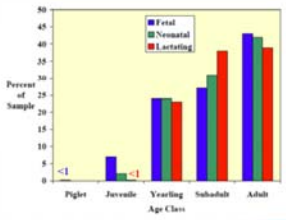
Wild Pig Reproductive Biology

Results – Female Parameters

Female age class participation in reproduction:

Percent composition increased with age for

- Pregnant sows (N=712)
- Sows with neonatal litters in farrowing nests (N=45)
- Lactating sows (N=348)



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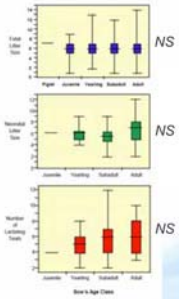
Wild Pig Reproductive Biology

Results – Female Parameters

Litter size variation due to sow's age class:

- Litter size did not significantly increase with age class of the sow for the following samples –
  - Fetal Litter Size (N=712)
  - Neonatal Litter Size (N=45)
  - Number of Lactating Teats (N=348)



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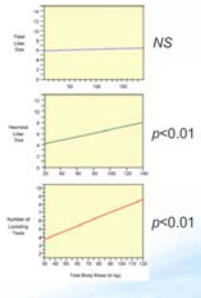
Wild Pig Reproductive Biology

Results – Female Parameters

Litter size variation due to sow's total body mass (TBM):

- Litter size did not significantly increase with the sow's TBM for fetal litter size (N=712 sows)
- Litter size did significantly increase ($p<0.01$) with the sow's TBM for -
  - Neonatal litter size (N=45 sows)
  - Number of lactating teats (N=348 sows)



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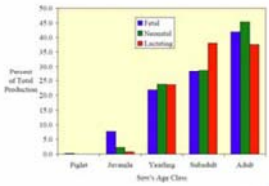
Wild Pig Reproductive Biology

Results – Female Parameters

Age class specific production of offspring:

- Total numbers of offspring produced did significantly increase with the sow's age for -
  - Fetal sample (N=4,383)
  - Neonatal sample (N=269)
  - Lactation sample (N=1,993)



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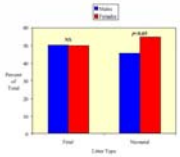
Wild Pig Reproductive Biology

Results – Litter Size

Litter sex ratio:

- **Based on a sample of 1,110 fetuses, 556 were males and 554 were females (NS)**
- **Based on a sample of 446 neonates, 202 were males and 243 were females (p<0.05)**



Sex	M	M:F	F
Fetal	3%	95%	2%
Neonatal	7%	84%	9%

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Wild Pig Reproductive Biology

Results – Male Parameters

- Total of N=721 boars examined
- Most boars don't significantly participate in breeding until yearling age class
- Based on presence of open wounds and scars indicative of male-male fighting, over 70 percent of active breeding boars are adults
- One captive SRS boar (~4-5 months old) bred five much larger adult sows in same enclosure

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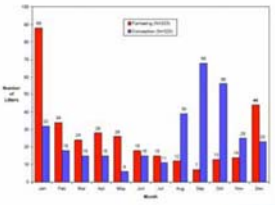
Wild Pig Reproductive Biology

Results - Breeding Season

Breeding season (N=323):

- Occurs year-round
- Peak of conception in Sep (Aug-Oct)
- Peak of farrowing in Jan (Dec-Feb)
- Secondary peaks
  - Conception - Jan
  - Farrowing – Apr-May



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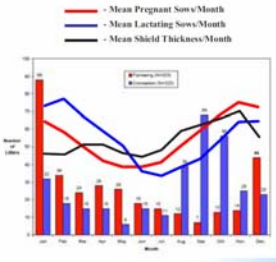
Wild Pig Reproductive Biology

Results - Breeding Season

Breeding season:

- **Comparisons with –**
  - **Mean percent of pregnant sows per month**
  - **Mean percent of lactating sows per month**
  - **Mean thickness of the shoulder shields per month**



SRNL

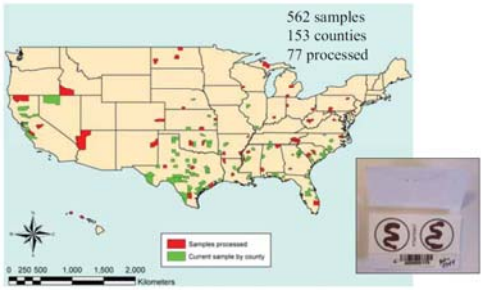
Genetic relatedness of feral pigs in the United States: national and regional perspectives with implications for management

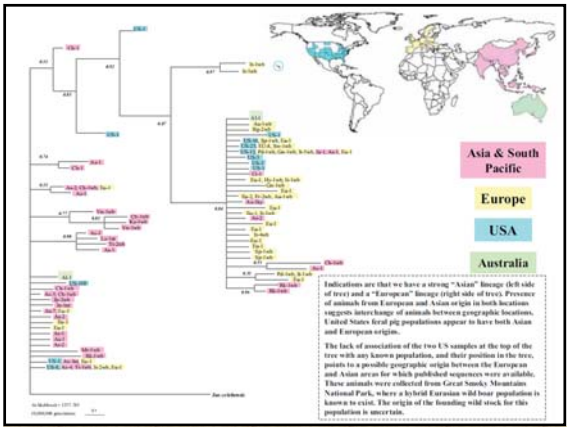
Blake McCann[1], Brandon Schmit[2], Seth Swafford[2], Richard Sweitzer[3], and Rebecca Simmons[1]

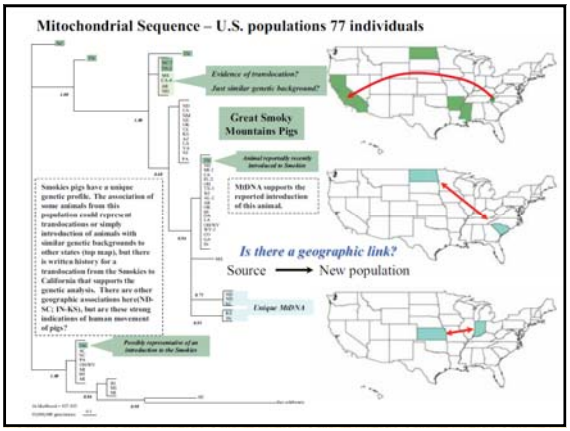
[1] Department of Biology, University of North Dakota, Grand Forks, ND, USA
[2] United States Department of Agriculture, Wildlife Services, Fort Collins, CO, USA
[3] University of California, Berkeley, Bass Lake, CA, USA

Objectives

1. Determine relatedness and origins of pig populations in U.S.
2. Identify source populations for new introductions







Key Findings

U.S. feral populations are of European and Asian origins

Written histories of translocation (e.g. Smokies – California) corroborated

Unique genetic profiles (ND, WV, CA, Asian lineage, Smokies) present

- useful for identifying sources of newly established populations

A combination of Mitochondrial and Nuclear markers is necessary

Tremendous opportunity for improved management of feral swine!

- identification of domestic and wild origins

- tracking and stopping translocations

- tracking potential for spread of disease

Breeding Potential versus Population Control

- Population reduced by 70% will rebound within 2.5 years
- Population reduced by 95% will rebound in less than 5 years!!!

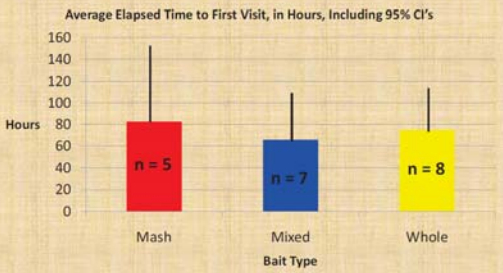
Utility of Simple Baits for Camera Surveys of Wild Pigs

Brian L. Williams
Robert W. Holtfreter
Dr. Stephen Ditchkoff
Dr. James B. Grand
James B. Armstrong
April 13, 2010

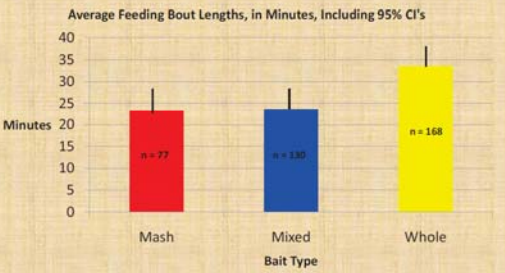
Methods

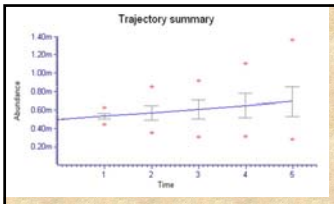
- 36 sites…each randomly assigned to 1 of 3 baits
  - Mash (Soured Corn)
  - Mix
  - **-- Whole**

Results



Results

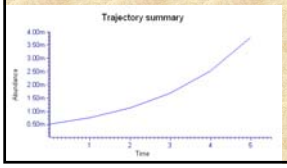


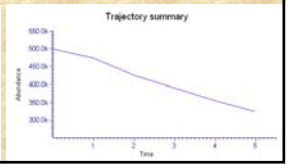


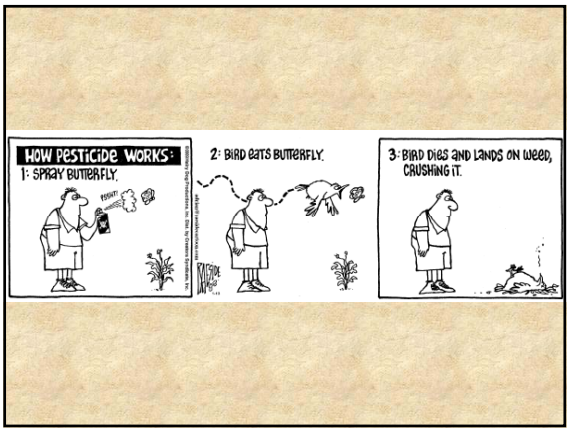
"Best Guess Scenario"
1 million to 2.74 mill. In 5 yrs

"Best Case Scenario"
1 million to 7.6 million in 5 years

"Worst Case Scenario"
1 million to 0.65 million in 5 years







Developing New Tools for Feral Pig Control: A Novel Toxicant in the U.S.

Nolan E. Davis, Richard M. Poché, and Tyler A. Campbell

- on average, feral pigs consumed 4.2 lbs more of the bait without flavoring compared to that with strawberry flavoring
- treatments with diphacinone were ineffective in controlling feral pigs, whereas treatments with warfarin were more effective
- test showed that a pig specific feeder will be needed for any toxicant used

Protecting agriculture and threatened species through the use of a human food preservative

A/Prof Steve Lapidge
Invasive Animals CRC, Uptake Programme Leader, Adelaide.
2010 Fulbright Professional Business/Industry Scholar, USDA National Wildlife Research Center, CO.

Invasive Animals Cooperative Research Centre
"Together, create and apply solutions"

Feral swine in USA

- Spread from 9 states 30 years ago to 44 states today.
- Population estimated to exceed 4 million.
- Economic impact is predicted by Pimentel to near $1 billion annually.
- Mixed legal status in US states- invasive, game, unclassified.

Why do we need a new pig toxin?

- Poisoning is 11x cheaper than shooting and 80x cheaper than trapping (Coblentz and Baber 1987 JAE).
- Currently 3 toxins legally used for feral pig control:
  - 1080: *humane?, death 4-20hrs, non-selective at pig dose, no antidote, restricted access.*
  - Phosphorous: *inhumane, death 2-4 days, non-selective.*
  - Warfarin: *inhumane, death 1-2 wks, selective, antidote.*
- *National Threat Abatement Plan* requires innovative and humane techniques to control damage by pigs.

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Desirable attributes of a new toxin

Safe for humans ☑	Antidote ☑
Highly toxic for pigs ☑	Cheap ☑
Bait deliverable ☑	Food product ☑
Target specific ☒	Registration studies ☑
Humane ☑	Publicly acceptable ☑
Low/no residues ☑	

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MANGEL POISONING

New Zealand Journal of Agriculture Research **1942**

Toxicity of Certain Salts of Sodium and Potassium for Swine

By Ronald Gwatkin and P. J. G. Plummer*

Canadian Journal of Comparative Medicine **1946**

NITRITE POISONING OF PIGS.

By W. R. Winks, B.Sc., A.A.C.I. (Senior Toxicologist, Chemical Laboratory, Division of Plant Industry); A. K. Sutherland, B.V.Sc., M.S. (Senior Veterinary Pathologist, Division of Animal Industry); and R. M. Salisbury, B.V.Sc. (formerly Assistant Veterinary Officer, Division of Animal Industry; now of Animal Research Station, Wallaceville, New Zealand).

The Queensland Journal of Agricultural Science **1950**

An Attempt to Produce Chronic Nitrite Toxicosis in Swine

W. T. London, D.V.M., M.S.; Wilson Henderson, D.V.M., M.S.A.; R. F. Crum, D.V.M., Ph.D.

Journal of the American Veterinary Medical Association **1967**

Sodium nitrite is the main meat and fish preservative used worldwide

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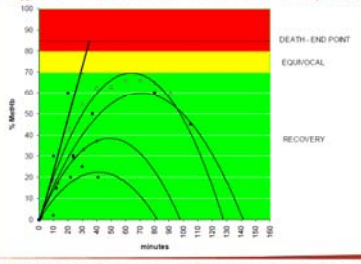
What is methemoglobinemia?

- the oxidation of hemoglobin to methemoglobin which can not carry oxygen.

- methemoglobin reductase reverses the process.



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Bait delivery to US pigs will require a species-specific hopper

- Campbell & colleagues have clearly shown that AUS pig baits are not pig specific in USA.
- Bait-delivery to pigs will require the development of a species-specific hopper.
- Numerous prototypes are current under development and being field trialled.

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The development of nitrite in the USA

- IACRC is currently working cooperatively with NWRC Wildlife Services.
- Nitrite toxicosis is quick and humane, reversible and leaves low/no residues in carcases.
- Such properties may mean nitrite is suitable for other species, such as rodents.
- Species-tailored delivery techniques will be required for each species.
- Non-toxic feral swine hopper trials will shortly be underway in Texas, Florida, Mississippi, Oklahoma, Michigan and Missouri.

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THE DEVELOPMENT OF THE 'ULTIMATE' FERAL HOG BAIT HOPPER

Are we heading in the right direction?

A/Prof Steve Lapidge
Programme Leader- Product & Strategy Uptake
2010 Fulbright Professional Business/Industry Scholar

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UK- fera Boar Operated System™

- Developed by FERA to deliver anti-fertility baits to European boar.
- Pros- high target-specificity in UK, USA; transportable; durable; weather proof.
- Cons- heavy; price; few baits; targets adults, monopolization, spillage.

Massei *et al.* 2010. *Journal of Wildlife Management* 74: 333-336.

Spain- Piglet feeder

- Developed by IREC to deliver vaccine baits to European boar.
- Pros- excludes large mammals; transportable; durable.
- Cons- heavy; bulky; price?; only targets piglets; little target-specificity; weather-proof?

Ballesteros *et al.* 2009. *Wildlife Research* 36: 203-212.

NZ- CONNOVATION bait hopper

- Developed by Connovation to deliver nitrite baits to feral pigs.
- Pros- cheap; easy to use; large hopper.
- Cons- doesn't self-reset; not target-specific; temporary; bulky; prone to weather.

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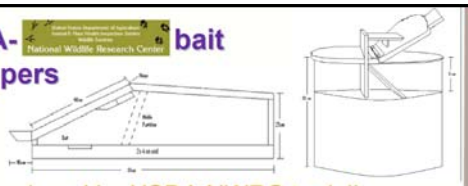
USA- National Wildlife Research Center bait hoppers



- Developed by USDA NWRC to deliver pharmaceutical baits to feral swine.
- Pros- cheap; easy to use; self-closes; large hoppers.
- Cons- not target-specific; wood construction; bulky for transport.

Long *et al.* 2010. *Rangelands* 32: April

AUS- Invasive Animals CRC bait hoppers

- Developed by IA CRC to simultaneously deliver toxic bait to large mobs of feral pigs.
- Pros- target-specific; durable; large hopper; weather proof; flat packs; easy to use; multi entrance.
- Cons- BB heavy & expensive; price; NT risk. HH still $400.

Lapidge *et al.* 2009. *Wildlife Damage Management Conference* 13: 49-59.

What to do about black bears?

- Black bears and feral swine co-exist in some states - Florida, California – but certainly not all.
- Use biology to separate species- bait in winter.
- Trap and shoot pigs when bears active.

Feral swine distribution

Black bear distribution

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Boar Operated System™

- Developed in the UK for delivery of anti-fertility baits.
- Texas trials excluded all species, except scraps from racoons (bait design dependent).
- Tetracycline trials marked 97% of adults and 91% of juveniles with no sex bias (plus 15% of racoons). No other species accessed bait.

Feral pigs readily access lift devices

Racoons can not

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Feral Hog Control

2008 Medina County
Dryland Yellow Corn
July 21, 2008

Tyler Campbell

Barbed Wire Fence

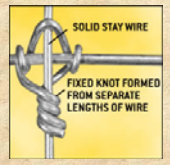
- This requires multiple strands of barbed wire with at least 7 strands of high tensile 4pt barbed wire
- 14g or 15½g high tensile barbed wire should be used since barbed wire will not stretch or sag under pressure. 12½g standard barbed wire can not withstand pressure and will stretch and sag resulting in feral hogs slipping between or under the strand of barbed wire
- Placed first strand at ground level and 5" on center for next 30"
- Post spacings should not exceed 10 to 12 feet
- This fence is costly to install but would control feral hogs from entering crop land

Tyler Campbell

Fixed Knot Fence

- This is only fence that can deter feral hogs from entering crop area
- Fixed knot utilizes solid vertical stay wires, which increase the vertical strength of the fence and allow for increased post spacing. Standard post spacing should be no closer than 20' on centers and can be up to 30' on centers with use of all pipe or wood for posts.
- The knot is a separate piece of wire tightly wrapped around the line wire and stay wire
- Fixed knot is very resistant to animal damage.
- For added security should add a strand of 4pt high tensile barbed wire at ground level to prevent any rooting by aggressive feral hogs

Tyler Campbell



735-6 FIXED KNOT FENCE PLUS TOP & BOTTOM STRAND OF PREDATOR WIRE

Tyler Campbell

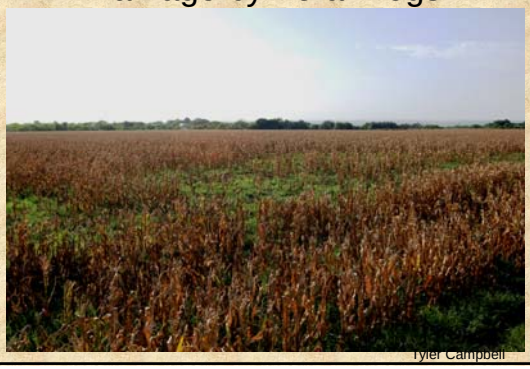
949-12 FIXED KNOT FENCE PLUS BOTTOM STRAND OF PREDATOR WIRE

Tyler Campbell

1348-6 FIXED KNOT PLUS STRAND OF HT BW TOP & BOTTOM

Tyler Campbell

Damage by Feral Hogs



Tyler Campbell

Typical Destruction by Feral Hogs

Tyler Campbell

Additional Damage

- Corn planted late in March with no moisture available – seed laid in dry dirt for 10 days before first rainfall
- A total of 6.4" rain fell during growing season which is reason for low yield

- Corn field with 949-12 fixed knot fence averaged – **55 bushels/acre**
- Corn field with no perimeter fence averaged – **41 bushels/acre**
- Net loss of 25%

Tyler Campbell

Heavy Brush Provides Cover and Easy Access Thru the Fence

Tyler Campbell

Location of Two Test Sites

Field with damage on left vs. Control on right with 949-12 fixed knot plus 4pt Gaucho BW 3"sp.

Tyler Campbell

Corn Field with 949-12 Fixed Knot on all Four Sides plus Strand of Gaucho Barbed Wire at Ground

Tyler Campbell

1/4 Mile Comparison Guide

The worksheet below will help you compare the overall cost and strength of specific systems.

Our example is based on 1/4 mile of fence in normal ground conditions. Prices are estimates and may not apply in all areas. Your design will vary depending on ground conditions and stock pressure. Material prices are estimates and may not accurately reflect current retail prices of listed material.

	735-6-330-12.5g Fixed Knot ZA			15.5 g HT 4pt Barbed Wire 3"sp Class 3			Adding to an Existing 5 Strand BW Fence 14g HT HJ 726-6-330' & 15g HT 4pt BW 3"sp Class 3		
Strength	1500 lbs minimum			950 lbs minimum			920 lbs minimum		
Post Spacings	20' centers & line post 100' centers			10' centers & line post 50' centers			10' centers & line post 50' centers		
	Quantity	Unit Price	Total	Quantity	Unit Price	Total	Quantity	Unit Price	Total
Brace Assemblies	2	$ 80.00	$ 160.00	2	$ 80.00	$ 160.00	0		$ -
Line Posts	12	$ 15.00	$ 180.00	24	$ 15.00	$ 360.00	0		$ -
T-Posts	52	$ 5.00	$ 260.00	117	$ 5.00	$ 585.00	0		$ -
Fence	4	$ 145.00	$ 580.00	0		$ -	4	$ 95.00	$ 380.00
Barbed Wire	1	$ 50.00	$ 50.00	7	50	$ 350.00	1	$ 50.00	$ 50.00
Total Material Cost			$ 1,230.00			$ 1,455.00			$ 430.00
	Quantity	Unit Price	Total	Quantity	Unit Price	Total	Quantity	Unit Price	Total
Total Labor Cost/Ft	1320	$ 2.00	$ 2,640.00	1320	$ 2.00	$ 2,640.00	1320	$ 1.50	$ 1,980.00
Total Project Cost			$ 3,870.00			$ 4,095.00			$ 2,410.00
Cost / Foot			$ 2.93			$ 3.10			$ 1.83
Life Expectancy (years)			25			25			25
Cost / Year			$ 154.80			$ 163.80			$ 96.40

Tyler Campbell

FERAL SWINE BEHAVIOR RELATIVE TO AERIAL GUNNING IN SOUTHERN TEXAS

Campbell et al

- **Home range size and core area did not differ before and after aerial hunting**
- **Movement rate higher during hunting!**

Pigs Under Pressure: Evaluation of Fences for Containing Motivated Feral Swine During Depopulation

Michael Lavelle
Kurt VerCauteren
Justin Fischer
Gregory Phillips
Trevor Hefley
Scott Hygnstrom
Seth Swafford
David Long
Tyler Campbell

Objective: Evaluate means to quickly and effectively contain feral pigs during disease outbreak

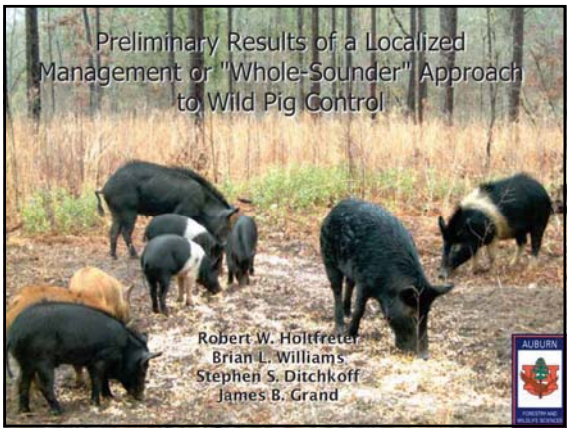
- **evaluated 5 candidate fences**
- **selected 34 inch hog panel for extensive testing**
- **pigs confined in 164 x 246 ft pens for 4-14 days**
- **subjected to progressive levels of motivation:**
  1. **minimal disturbance**
  2. **pursuit by humans with paintball guns**
  3. **pursuit by gunners in helicopter**

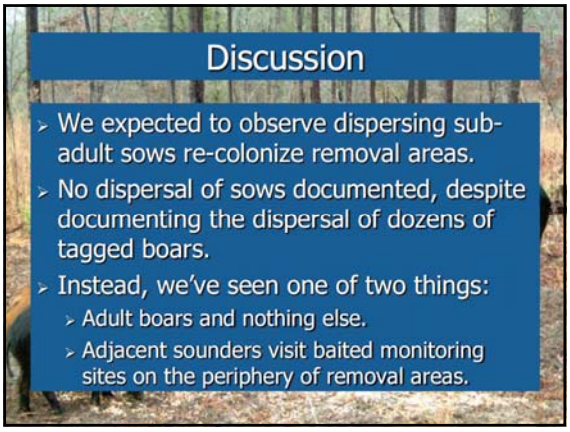
Results

- **97% successful (minimal disturbance)**
- **83% successful (paintball gunners)**
- **100% successful (helicopter gunners)**

- **1 of 6 pigs escaped during 14 day trials**

- **Hog panel exclosures relatively inexpensive: $5.26 per yard (excluding labor).**





Pros/Cons

- In places where pigs are mostly black, unique identification may be difficult.
- Requires attention to detail, patience, and in some cases, persistence.
- Unique sounders can be identified, trapped and removed.
- Large areas can be cleared of pigs for long periods of time.

Questions?