Developing and Implementing Feral Hog Management Procedures on an Urban Nature Center

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ABSTRACT: Feral hog populations have long been established in Texas. Expanding hog populations and increasing urban sprawl have brought humans and feral hogs into contact even in urban areas. The Fort Worth Nature Center & Refuge is a 3,600+ acre urban green space owned by the City of Fort Worth and managed by employees of the City’s Parks and Community Services Department as a natural, native landscape. Evidence of feral hog activity on the site was first documented in 1999. Efforts to develop a suitable control plan that would protect the natural resources of the refuge, while being cognizant of internal and external stakeholders’ diverse concerns, were undertaken over a 2-year period. These efforts culminated in the implementation of a successful ongoing trap and euthanize feral hog control program that has received wide acceptance from all stakeholders.

KEY WORDS: feral hogs, humane euthanasia, live traps, public sensitivity, shooting, Sus scrofa, vertebrate pest control

INTRODUCTION
Urban nature centers often find themselves with a dilemma—wanting to use best management practices on their land, but unable to because of their urban location. This is sometimes due to the relatively small acreages under their control, but it is more frequently because of a lack of stakeholder understanding of the problems and the associated solutions available. All of this is compounded by the prevalence of the media in an urban area and the nature center’s perception of being under the public microscope.

Internal stakeholders, i.e., municipal government departments, often deny permission to use accepted resource management techniques because they are perceived as having inherent dangers that could leave the municipality liable. They also tend to compartmentalize employees and refrain from empowering them to using skills that fall outside their traditional job descriptions. These effects are compounded by a general lack of understanding of resource management goals and objectives.

External stakeholders, including local conservation and other user groups, often have a basic understanding of the urban nature center’s goals but lack knowledge of accepted techniques. Unlike internal stakeholders, external stakeholders believe that urban nature centers possess the ultimate authority regarding how their natural resources are managed.

The dilemma for urban nature centers reaches a pinnacle when a management situation arises that requires a shift in paradigm and significant support from all stakeholders. The Fort Worth Nature Center & Refuge faced this dilemma in developing and implementing a feral hog (Sus scrofa) control program within its boundaries.

BACKGROUND
The Fort Worth Nature Center & Refuge (FWNC&R) is an urban green space owned by the City of Fort Worth (CFW) and managed by employees of the City’s Parks and Community Services Department as a natural, native landscape. The FWNC&R lies wholly within the political boundaries of the City of Fort Worth on the northwest edge of the city’s limits. The refuge is comprised of 1450+ hectares (3,600+ acres), bisected by the West Fork of the Trinity River, and originally restricted from development in 1913 to preserve water quality in the downstream Lake Worth Reservoir. A mosaic of riparian, prairie, oak savanna, and western CrossTimbers habitats is found on the site. An incomplete boundary fence surrounds the site which, in combination with the West Fork of the Trinity River and a number of seasonal watercourses, provides avenues of egress and ingress for native and introduced wildlife.

Specific resource management objectives are to conserve, maintain, and/or restore plant and animal communities native to North Central Texas. This includes controlling the introduction and spread of exotic plants and animals, with eradication as the ultimate goal.

Although owned by the City of Fort Worth, the FWNC&R serves the North Central Texas region, a 16-county area with a total population of over 6 million persons. Approximately 150,000 people, representing a cross-section of the regional population, visit the FWNC&R annually to participate in the nature center’s educational programs and to participate in the recreational opportunities afforded by the urban wilderness.

Feral hog populations have long been established in Texas (Mapston 2004). They are considered to be an important game species by some (Rollins 1993) and a destructive nuisance by others (Beach 1993). Expanding hog populations and increasing urban sprawl have brought humans and feral hogs into contact, even in urban areas (Brown 1985).

Feral hogs are known to cause an array of environmental damage. Tate (1984) reported a reduction in plant cover on the forest floor following hog rooting. Soil disturbance from rooting encourages an increase in early succession plants, including exotic and invasive species (Springer 1977). In California, feral hogs significantly

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Proc. 22nd Vertebr. Pest Conf. (R. M. Timm and J. M. O’Brien, Eds.)
Published at Univ. of Calif., Davis. 2006. Pp. 364-369.
reduced oak regeneration through rooting and acorn consumption (Sweitzer and Van Vuren 2002).

The effect of feral hogs on fauna is less clear, but they are known to prey upon invertebrates (Wood and Roark 1980), reptiles and amphibians (Springer 1975, Howe et al. 1981), small mammals (Wood and Roark 1980), fawns (Odocoileus spp.; Hellgren 1993), and ground-nesting birds (Rollins and Carroll 2001). Hogs also directly compete with a number of native species for food sources.

In an urban area, feral hogs pose a potential threat to property and human safety. Feral hogs are capable of inflicting injury upon humans (Lucas 1977, Tinsley 2002). They have been known to injure pets (Beach 1993). Hog-vehicle accidents often cause significant mechanical damage and injuries to the vehicle’s occupants (Nunley 1999).

Feral hogs were first documented on the FWNC&R in July 1999. Extensive soil disturbance, followed by direct sightings and confrontations between visitors and hogs, indicated a need for active control of the feral hog population. The FWNC&R had never experienced a situation that required direct control of a vertebrate species. Within the CFW, animal control of any kind was perceived as being under the purview of the City’s Department of Health–Animal Control. The Department of Health–Animal Control did not believe that they had the resources to deal with feral hog problems outside of traditional urban areas.

Animal population control, particularly in urban areas, is often met with strong, organized opposition. Public perception of any control program is of the utmost importance, so as to not jeopardize any potential support from the community. The FWNC&R staff was tasked with developing a feral hog control program that would significantly reduce, and potentially eliminate, the resident feral hog population while meeting the sometimes opposing needs of the various stakeholder groups.

**STAKEHOLDER CONCERNS**

Internal stakeholder groups, primarily CFW Departments, had varying concerns regarding implementation of a feral hog control program, based upon their own responsibilities to Fort Worth citizens and their perceptions of what the citizenry desired. Table 1 lists the key internal stakeholders and their primary concerns prior to development of the feral hog control plan. External stakeholder groups had their own concerns, ranging from the need for any control to specific facets of the control program. Table 2 summarizes the key external stakeholders and their primary concerns prior to plan development.

Addressing these concerns required educating group representatives on the realities of feral hog ecology and control options, as there were many misconceptions regarding the topic. It was also apparent that the various groups had little understanding of what the other groups’ actual concerns were and the limitations placed upon the control program by the groups, the feral hogs, and the physical and financial resources of the FWNC&R.

| Stakeholder Group | Primary Concerns |
|-------------------|-----------------|
| CFW Parks & Community Services Department | • How could visitor safety be improved?  
• How could FWNC&R resources be protected?  
• How would public react to control? |
| CFW Police Department | • Would firearms be used for control?  
• Who would be using firearms for control? |
| CFW Animal Control | • Who would be responsible for implementing a control program? |
| CFW Legal Department | • What liability could the City be exposed to? |
| CFW Risk Management Department | • What hazards to staff and the public exist with and without control? |
| CFW City Council | • How will citizens perceive a control program? |

Table 2. External stakeholders and their primary concerns regarding feral hog control on the FWNC&R.

| Stakeholder Group | Primary Concerns |
|-------------------|-----------------|
| Texas Parks & Wildlife Department | • Who will be responsible for implementing control program?  
• Will the control program employ legal methods? |
| USDA Wildlife Services | • Who will be responsible for implementing control program?  
• Will the control program employ legal methods? |
| Friends of the FWNC&R | • What control program would best achieve FWNC&R resource management goals? |
| Local Conservation Groups | • How can the FWNC&R resource best be protected? |
| Animal Welfare Groups | • Is control needed?  
• Are there non-lethal options?  
• Will animals be treated in a humane manner? |
| Local Media | • Will access to control operations be granted? |
| Local Hunters | • Will public hunting opportunities be available? |

**DEVELOPING MANAGEMENT PROCEDURES**

A thorough literature review and presentation of information to the stakeholder groups unified all groups in deciding that some form of feral hog control was needed. The use of exclusion or of trapping and relocation as non-lethal control measures were judged unfeasible. Exclusion, i.e., a hog-proof fence surrounding the FWNC&R, was beyond the financial resources of the CFW and would do nothing to control the feral hog population already on the property. Feral hog relocation requires a permit from the Texas Animal Health Commission (Texas Animal Health Commission 2003), and the local agent stated that no permit would be granted to relocate FWNC&R feral hogs. Chemosterilant use was proposed, but this technique is still in the development stage (Killian et al. 2003).
Stakeholder concerns for lethal control measures were categorized into 4 areas: control method, euthanasia method, carcass disposition, and who would be responsible for conducting control operations.

Lethal Control Options
Concern over control method centered on efficiency and humane treatment of captured animals. Controlled shooting, either by trained marksman over bait or in the form of a public hunt, was unacceptable to many internal and external stakeholders. Aerial hunting was impractical because of dense forest cover. Capturing hogs with dogs and using snares, while effectively used in other areas (Mapston 2004), was deemed inhumane and therefore not considered.

Live trapping, using portable cage traps and semi-permanent pen traps, was accepted as the safest, most efficient and humane capture method. These traps could be easily placed in areas of hog activity and operated only at night when the public was not present on the grounds. Non-target animals could be released unharmed.

Euthanasia Options
Internal and external stakeholders were in agreement that the most humane method of euthanasia should be employed. Initially, most stakeholders believed this to be through the use of euthanasia drugs. However, the American Veterinary Medical Association Panel on Euthanasia recommends a properly placed gunshot as a humane method for hog euthanasia in the field (Beaver 2001).

Gunshot was selected as the appropriate euthanasia method because of reduced cost, easier access to firearms and ammunition than euthanasia drugs, and the efficiency with which it could be employed. This efficiency leads to reduced time in the trap, especially in close proximity to humans, and reduced trap stress. The effort to reduce trap stress was appreciated by the animal welfare groups. One animal welfare group requested that a firearm caliber be used that would not cause an exit wound, as this was perceived to constitute inhumane treatment.

Carcass Disposition
Carcass disposition proved to be the most controversial component of the hog control program, as many stakeholders felt that any available meat should be given to homeless shelters or other charitable agencies. However, the FWNC&R lacked the resources to field dress and transport carcasses for processing.

A decision was made to disperse the hog carcasses among discreet disposition sites scattered in remote areas of the refuge where natural nutrient recycling could occur. Several reasons were used to justify this option. Ecologically, the hogs were robbing the native flora and fauna of resources, and this option returned these resources to the native ecosystem. Internal stakeholders realized that consuming feral hog meat could leave the City of Fort Worth open to liability should someone become ill afterwards. External stakeholders that agreed in principle with the need to remove exotic animals to protect a native landscape, but objected to using those animals for human benefit, also supported this option.

Responsible Department
Local, state, and federal agencies appeared, on the surface, to be likely candidates for taking responsibility to conduct control operations. However, these agencies proved to be unacceptable to stakeholders. CFW Animal Control is responsible for animal control operations within the City but was ill-equipped to carry out feral hog control in a natural landscape. Texas Parks and Wildlife Department claimed that since the feral hogs were on CFW property, that they were outside the state’s responsibility for control. USDA Wildlife Services agreed to provide professional trappers but required a monthly fee that was beyond the means of the FWNC&R’s budget and also required full discretionary authority over choice of control method and locations.

A cooperative effort between FWNC&R staff and the CFW Police was suggested. FWNC&R staff possessed the necessary knowledge and experience to effectively live trap feral hogs and had the ability and resources to work in a natural landscape. However, FWNC&R staff lacked the authority to carry or discharge firearms inside the city limits. It was suggested that after hogs were trapped, CFW Police officers be called to euthanize the animals. This option was found impractical because of the time required to transport police officers into backcountry areas. This extended time would result in additional capture stress, because of the additional time that animals would be confined in the trap. In addition, CFW Police could not predict their response time, and any delay could result in animals being euthanized while visitors were on the grounds.

The chosen option permitted selected members of the FWNC&R staff to conduct live trapping operations and to perform euthanasia on site upon receiving firearms training from CFW Police and City Council approval. Participation was limited to senior staff, and anyone else was specifically forbidden from participating. This option proved to be the most cost effective, environmentally sensitive, and humane method available and was acceptable to all stakeholders.

IMPLEMENTING MANAGEMENT PROCEDURES
FWNC&R staff began implementing the accepted management procedures in January 2003, immediately after gaining acceptance from stakeholders, receiving required training and permissions, and acquiring the requisite materials. During the following 3 years, 117 feral hogs were trapped, euthanized, and the carcasses disposed of on the FWNC&R. The control program’s effectiveness was evaluated in 4 areas: effect of hog removal on the FWNC&R, trapping efficiency, euthanasia efficiency, and stakeholder response.

Effect of Hog Removal on the FWNC&R
The removal of 117 feral hogs (54 males, 63 females) over a 3-year period led to a significant reduction in hog sightings. Almost daily sightings have been reduced to approximately monthly sightings. Two feral hog attacks, one of which resulted in severe injury to a leashed dog, occurred shortly before control was initiated. No attacks or confrontations have occurred since control efforts
began. Feral hog activity in high-public-use areas is almost nonexistent. Damage caused by feral hogs has experienced a similar reduction.

The 117 hog carcasses totaled 4,387.8 kg (9,673.5 lbs). The addition of a supplemental food source of this magnitude is assumed to have had a positive effect on scavenger populations. Anecdotal evidence indicates an increase in coyote (*Canis latrans*) and vulture (*Cathartes aura, Coragyps atratus*) populations following initiation of the control program.

Anecdotal evidence indicated a reduction in turkey (*Meleagris gallopavo*) and cottonmouth (*Agkistrodon piscivorus*) populations, due to feral hog predation prior to control program implementation. An apparent reduction in wood ducks (*Aix sponsa*) before control was believed to be caused by feral hog competition for mast. Populations of all 3 species appear to be recuperating as feral hog populations have been reduced.

**Trapping Efficiency**

In its initial stages, trapping was conducted whenever FWNC&R control staff schedules permitted, resulting in relatively inefficient trapping efforts. Acquired knowledge and experience improved trapping efficiency from 3.39 trap nights/hog in 2003 to 1.35 trap nights/hog in 2005, even as the feral hog population was reduced. Overall efficiency for the 3-year period was 2.20 trap nights/hog removed.

Trapping was conducted throughout the year, and captures were made in each month. January proved to be the most productive (52 hogs removed) and most efficient month (1.33 trap nights/hog). Preliminary analysis indicates that trapping efficiency improves when day-to-day temperatures are falling and the moon phase is full or gibbous (unpubl. data).

Two trap types were used: portable cage traps, and semi-permanent pen traps. Portable cage traps caught 104 feral hogs in 250 trap nights (2.40 trap nights/hog). Limited trials of the semi-permanent pen trap resulted in 13 trapped hogs in 7 trap nights (0.54 trap nights/hog). While the efficiency of the pen traps was greater than that of the portable cage traps, the semi-permanent nature of the pen traps limits its application in public areas of the FWNC&R.

The average cost/feral hog removed through the control program was approximately $60 after 3 years of control. This average cost, which includes start-up capital expenditures, consumable supplies, and labor, is predicted to decline as trapping efficiency improves.

**Euthanasia Efficiency**

Euthanasia efficiency, which is considered to have a direct relationship with humane treatment of the trapped animals, was of concern to stakeholder groups. Euthanasia efficiency, as defined here, includes the number of shots taken to euthanize the trapped hogs, the time that hogs were in the trap and subjected to the stress of having FWNC&R staff in close proximity, and the efforts taken to avoid bullets exiting the carcass, i.e., exit wounds. The euthanasia goal, as defined prior to initiating control, was a single non-exiting shot performed as quickly and safely as possible.

Having FWNC&R staff, traditionally not permitted to carry and discharge firearms inside city limits, euthanize trapped hogs with firearms was a primary concern for several internal stakeholders. One hundred seventy-five total shots were used to euthanize 117 trapped hogs (1.54 shots/hog). Increased experience improved efficiency from 1.64 shots/hog in 2003 to 1.13 shots/hog in 2005, as appropriate target areas and angles were identified. Specific data were not collected on exit wounds, but refinement of the preferred shooting angle all but eliminated the phenomenon.

To determine the length of time that trapped animals were subjected to the stress of FWNC&R staff present outside the trap, the time that hogs were first observed in the trap was recorded. The time of death of the last trapped hog was also recorded. The length of time between these events was recorded as euthanasia time for all animals in the trap. The average euthanasia time for the 117 removed feral hogs was 3.75 minutes. This figure is not indicative of the average time to euthanize an individual hog, but rather is the average time to euthanize all hogs in a trap (range = 1-13).

Average euthanasia time has remained stable during the 3 years of the control program despite an improvement in shooting efficiency. This can be explained by the increase in trapping efficiency, i.e., increased number of pigs/trap, and a better understanding of feral hog behavior and its relationship to humane euthanasia. Initially, trapped hogs were shot from a standing position and in no particular order, resulting in a number of ineffective shots. Current protocol requires the shooter to assume a sitting position and shooting posture approximately 0.9 m (3 feet) from the trap. Experience has shown that the dominant trapped hog will confront the shooter from close range and present a proper angle, i.e. head slightly lowered and facing the shooter. Euthanizing the dominant hog, results in the next highest ranking hog performing the same behavior. Repeating this process until all hogs have been euthanized minimizes euthanasia time and results in relatively little undue stress on the trapped animals.

**Stakeholder Response**

Internal stakeholder response to the feral hog control program has been supportive. After 3 years of operation, concerns about the program have waned, while funding has continued to be available. The FWNC&R has also been consulted by other CFW departments, as feral hog issues have appeared in other areas of the city.

External stakeholders initially exhibited a mix of responses. Texas Parks and Wildlife and the USDA Wildlife Services showed initial and continuing support of the FWNC&R’s control efforts. Local conservation/environmental groups were equally supportive, with one exception.

The animal welfare groups were generally supportive. Some groups chose not to openly support the control program but, more importantly, did not openly oppose it despite attempts by the local media to “stir the pot”. The Humane Society of the United States has openly supported the FWNC&R’s efforts and has maintained open lines of communication with the FWNC&R staff to
facilitate improvements in all facets of the program. Local hunters and the general public individually expressed opposition to the program because they viewed it as a loss of hunting opportunity, and they lamented the perceived waste of meat because of the carcass disposition method. Approximately 6% of all comments received from individuals were opposed to the control program.

The local media, seeing the potential for conflict, initially opted to create a story by contacting stakeholders, particularly those perceived to be anti-control, for comment. Because these groups had been involved in the development of the control procedures, they refrained from opposing the control program. Media interest in the control program lingered for approximately 1 year. Since they were unable to film or photograph any trapped or euthanized hogs, media interest eventually waned.

Overall, stakeholder response to the program has been fully supportive. This is due to their involvement in creating feral hog management procedures from the beginning stages.

SUMMARY
Conducting what may appear to be standard resource management protocols on urban nature centers is often difficult because of the impact of internal and external stakeholders’ concerns. The Fort Worth Nature Center & Refuge was able to develop and implement management procedures to lethally control invasive feral hogs to protect the natural resources of the site and its human visitors by openly interacting and communicating with all stakeholders. FWNC&R staff often had to play the role of liaison between the various stakeholder groups to achieve its objective: reduction and potential eradication of feral hogs to preserve FWNC&R natural resources and visitors in the safest, most efficient, ecologically sensitive and humane manner possible.

Lessons Learned
Specific lessons learned from this experience include:

Work Openly With All Stakeholders
It is imperative that resource managers admit to any limitation placed upon them by their governing authority. Many stakeholder groups mistakenly believe that resource managers have the ultimate decision-making authority. Most stakeholders can understand limitations of budget, safety, and liability and will factor these limitations in against their own agendas.

When interacting with the media, an external stakeholder, resource managers should “keep no secrets but give no details”. This translates to engaging in open communication regarding the “why” and “how” of management procedures but refrains from publicizing how many hogs were trapped, their size, etc. Such information begins to take the form of boasting, as observed in local hunting tales.

Employ Sensitivity and Media Training
Resource managers should choose their words carefully. If they have engaged in the process to gain the support of stakeholder groups that would traditionally oppose their methods, it is imperative that they not endanger the relationship through a poor choice of words. In the FWNC&R case, the words “hunting” and “trapping” were never used to describe the control program because of the sporting and consumptive connotations of the words. Feral hogs were not “killed” or “shot”, they were euthanized. Special attention should be paid to the media’s use of such loaded words and every effort made to correct them. While this may be a simple matter of semantics, word choice can reflect poorly on the overall program.

Include All Possibilities in the Plan
While it is impossible to plan for every possible scenario, resource managers should make every effort to do just that. The FWNC&R’s feral hog control procedures included every scenario imagined by the staff, including the unlikely but possible situation of a CFW City Council member demanding the opportunity to accompany FWNC&R staff during hog control efforts. This was considered a possibility if a City Council member desired to turn the control program into a personal hog hunt. The solution to this scenario was in limiting participation to senior FWNC&R staff members and specifically forbidding any other person from participating, which was then signed into law by the CFW City Council. In addition to preventing anyone in authority from pursuing a personal agenda in regards to the hog control program, this policy prevented media members from obtaining film, photographs, or verbal descriptions of potentially sensitive aspects of the control program.

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