The Effectiveness of TNR Programs:
Why Eradication Does Not Work

Every day, more and more sterilization programs for feral cats are being implemented across the United States and around the world. Compassionate communities are embracing this humane, nonlethal method of managing community cats, not only because it preserves innocent life, but also simply because it is effective. Unlike its traditional counterpart, catch-and-kill, which has been practiced for decades, Trap-Neuter-Return (TNR) programs stabilize populations, improve the overall health of outdoor cats, and reduce shelter in-take numbers, costs, and euthanasia rates. In addition, such programs drive community involvement and encourage compassionate actions.

TNR is Effective, Reduces Costs, and is Humane

Proven Effective to Reduce Feral Cat Populations and Reduce Shelter Euthanasia Rates

Along with sterilizing community cats, many kittens are removed from the colony and placed into an adoption program when colonies are TNR'd. This immediately reduces the size of the colonies. Friendly, stray cats are scanned for microchips and returned to their guardians or rehomed. Any cats who can be socialized are also placed into an adoption program, further immediately reducing the number of cats in a colony.

Alley Cat Rescue took a national survey of colony caretakers in 2012, 2017, and again in 2019. The data from these surveys, combined with data from Animals 24-7's 1992 and 1996 national surveys, revealed a "48% decline in kitten births in monitored neuter/return colonies during the first years that neuter/return was practiced. Between 2012 to 2017, kitten births dropped 72% and between 2017 and 2019, they had dropped by 77%" (Clifton, 2021).

A University of Florida study found that spaying/neutering community cats led to a dramatic decline in the number of cats who were admitted to and euthanized by the local shelter (Levy et al., 2014). During the two-year study, the shelter staff TNR'd 2,366 community cats (an estimated 54 percent of the feral cat population in the targeted area), with most of the cats being returned to the site and some being adopted (Levy et al., 2014). After implementing TNR, the shelter's intake of cats in that area decreased by 66 percent and the shelter euthanasia rate for cats dropped by 95 percent (Levy et al., 2014). In addition, this TNR project reduced cat intake by animal control for the entire county by 13 percent and shelter euthanasia rate by 30 percent (Levy et al., 2014).

Another successful TNR program took place at the University of New South Wales (UNSW) in Sydney, Australia. Over the course of nine years, and supplemented by the rehoming of "socializable cats and kittens" (Swarbrick and Rand, 2018), TNR reduced the free-roaming cat population from 69 to 15 cats. Subsequent institutional support for the program was strong because of a reduction in complaints from campus staff and students, the minimal institutional costs, and the improved health status of the remaining cats (Swarbrick and Rand, 2018).

In Italy, where the national law for managing feral cats is a no-kill policy, TNR programs have been in place for more than a decade. Colony caretakers, who once worked under a shadow of fear and persecution, now have the freedom to carry out the necessary steps of a proper TNR program. One Italian study revealed that with TNR, the average number of cats per colony decreased between 16 percent and 32 percent over a few years, but the researchers also concluded that further education of the larger community would be necessary to make TNR fully effective (Natoli et al., 2006).

Nancy North

A well-known cat sanctuary in Rome called Torre Argentina agrees that education is key to managing community cat populations. Torre Argentina educates about the importance of sterilization in its public outreach. They believe that public education has led to more Romans sterilizing their own companion animals, which in turn has led to a decline in sterilizations at the sanctuary since 2008 ("Torre Argentina's Cat News," accessed 2015).

Less Costly and Less Time-Intensive Than Eradication

Unlike eradication programs, which are paid for using tax dollars, most TNR programs operate using private money and volunteers carry out the work. A study commissioned by Best Friends Animal Society and funded by Petsmart Charities found that TNR programs for free-roaming cats can cut outdoor cat management costs in half. The study says that with an estimated 87 million free-roaming, community cats in the United States, it would cost governmental entities about $16 billion to trap and kill these cats as opposed to about $9 billion to support TNR programs run by rescue organizations and individual volunteers ("New Research Exposes High Taxpayer Cost for 'Eradicating' Free-Roaming," 2010).

As part of a population modeling project for the Alliance for Contraception in Cats and Dogs, a team of researchers conducted an economic analysis of both TNR and catch-and-kill. Their results also support TNR as the more cost-effective solution to managing community cats. According to the study, the cost of catch-and-kill methods are 4.5 to 9 times *greater* than TNR, as projected over a seven-year period (Miller et al., 2014).

A study was published in 2021 that used computer simulated modeling to compare the costs of TNR and other removal methods (including euthanasia) of free-roaming cats. The study showed that, while removal and euthanization of 75 percent of all cats in a target area was the most efficient approach in reducing the total cat population, it would cost more than to trap, sterilize, and release the same percentage of the cats in the area. Additionally, although removal of cats led to the quickest decline in feral cat population size, high-intensity TNR could be as effec-

tive and reduce a population by the same amount as removal after an extended period of time. A final, important comparison determined by this study is that, "Of five management scenarios that reduced the final population size by approximately 45%, the three scenarios that relied exclusively on removal were considerably more expensive than the two scenarios that relied exclusively or primarily on sterilization" (Benka et al., 2021).

Addresses Public Health Concerns

Linda Tanner

Feral family at Crescent City Harbor wharf, Crescent City, CA

TNR programs provide community cats with vaccinations that prevent the transmission of diseases to humans and to other cats. At minimum, a rabies vaccine is administered, which creates a buffer zone between wildlife and humans. "By keeping a critical mass (usually 80 percent) of feral cats vaccinated against rabies in managed colonies, a herd immunity effect may be produced, potentially providing a barrier between wildlife and humans and preventing one of the major public health threats caused by feral cats" (Slater, 2002). The distemper and feline leukemia (FeLV) vaccines also prevent the transmission of those diseases to other cats.

Providing community cats with vaccines decreases the chance of the public coming in contact with an unvaccinated cat. Ron Cash, the former business administrator of Atlantic City who oversaw the Department of Health and Human Services, has said, "TNR is good public health policy." Prior to implementing TNR for the cats living on the Atlantic City boardwalk, Cash said he received numerous calls from the public about the cats. However, after observing the results of TNR he said, "The [cat] population that's here is much healthier. They're coexisting with people very well now" ("Business Administrator Ron Cash," accessed 2013).

Returning feral cats to their outdoor homes after sterilization also ensures rodent populations are kept in check; maintaining low rodent populations helps prevent the spread of disease. Fitzgerald and Turner, among others, studied cats and their prey for over 20 years in a mostly uninhabited forest in New Zealand, and their research clearly shows how cats keep rodent populations in check. In the beginning of the study, cats were common and the rat population was "low and stable." However, as the study continued and cats were trapped, leaving only a few individuals in the area, the number of rats began to increase slowly. After several years with only a few cats present, the rat population "peaked at about five times their original numbers" (Fitzgerald and Turner, 2000).

During the 14th century, the Black Plague claimed the lives of over 25 million people. This was partly because, years earlier, Europe's witch hunts had brought the continent's cat population almost to extinction. The low cat population meant a high rodent population, which made for the spread of disease. It wasn't until the Age of Exploration, when cats began accompanying sailors on their voyages to new lands (to control the rat stowaways), that the cat

became popular again.

TNR Improves Cats' Health, While Helping Them Become Better Neighbors

Along with reducing and stabilizing feral cat populations, TNR programs also improve the overall health of outdoor cats; cats are relieved from the constant stresses of mating and pregnancy. In one study, veterinarians examined the effects of sterilization on feral cat health by measuring the body condition of 14 feral cats upon trapping, and then taking measurements one year following sterilization. When trapped initially, the cats were lean though not emaciated. One year after being sterilized, the cats showed significant increases in weight and improvements in body condition. In addition, caregivers reported that the cats had a decreased tendency to roam after being neutered (Scott et al., 2002).

Another study conducted from 2012 to 2014 in Israel found that "In general, the health of sterilized free-roaming cats was found to be superior to that of intact free-roaming cats" ("Sterilization improves the overall health of free-roaming cats in urban study," 2020) According to the study, sterilizing cats within an area seems to positively affect the health of *un*sterilized cats in that area as well ("Sterilization improves the overall health of free-roaming cats in urban study," 2020).

On average, spayed females live 39 percent longer than unspayed females, and neutered males live a full 62 percent longer than those unneutered (Banfield Pet Hospital, 2013). Sterilization greatly decreases the risk of certain cancers (uterine, mammary, testicular, prostate), while providing vaccines prevents the spread of disease. Neutering male cats also decreases fighting (for mates and territory), which leads to the reduced risk of transmission of diseases, particularly FIV and FeLV (Banfield Pet Hospital, 2013).

In addition, sterilizing both female and male cats decreases their need to roam in search of mates, which decreases the risk of injury. Unneutered cats are at four times the risk of being hit by cars than neutered cats, and three times more likely to need treatment for an animal bite (Banfield Pet Hospital, 2013). Most TNR programs also treat cats for internal and external parasites to address disease and potential malnutrition.

Lastly, caretakers provide daily food and fresh water to colonies of TNR'd cats; a proper diet leads to improved health and reduces the need to roam in search of food. Any cats showing signs of illness or injury are promptly trapped and treated accordingly.

Sterilization greatly reduces yowling, fighting, and spraying, so complaint calls to animal agencies are decreased. Helping feral cats become better neighbors improves community morale (Hughes et al., 2002).

Drives Community Involvement and Promotes Compassion

Implementing local TNR programs helps drive community involvement and encourages compassionate action. TNR also creates opportunities for outreach, education, and cooperation. Cats and dogs play a large role in the lives of most Americans and these animals are treated like family members. Today's society also has a heightened awareness of the staggering euthanasia rates occurring in animal shelters, and there is more determination than ever to reduce the killing of healthy animals. Rather than a simple problem of too many animals, many view the situation "as a people problem — the result of the human-

animal bond failure," which makes "the killing of animals an unacceptable response" (Hughes et al., 2002).

The traditional catch-and- kill method is no longer viewed as morally acceptable; many individuals would rather see a cat sterilized and returned to the site over having the cat trapped and killed. A 2014 national U.S. survey conducted by Baell Research revealed that 73% of respondents believed it is more humane to leave a feral cat where she is than to bring her to a shelter to be euthanized, while only 9% believed euthanasia is better for a cat, and 18% skipped the question or said they did not know (Wolf and Schaffner, 2019).

According to the 2021-2022 survey by the American Pet Products Association, 24 percent of pet cats have been acquired as strays or caught from outside ("Pets by the Numbers," accessed 2022). Compassionate people feed and care for homeless cats. They use their own time and money to fulfill the basic needs of these animals. When they are given the proper tools (access to low-cost TNR services) and they are permitted to conduct TNR without penalty (fines, jail time), they are able to help more cats. TNR programs *encourage* individuals to get involved and make a difference in their communities. TNR also establishes a point of contact for concerns about the cats and for resolving any community issues.

Eradication is Ineffective, Costly, and Cruel

Once an eradication program has started, in order to be successful, it must continue until all targeted individuals have been killed. A primary weakness of eradication programs is that it is nearly impossible to identify all targeted subjects, let alone determine if they have all been killed, and when they are not, the breeding cycle will repopulate the area. Since individuals become trap-shy or immune to introduced disease, it becomes more difficult to kill the last few individuals.

A mistaken assumption that eradication is complete when it really isn't can have disastrous consequences; "the species can bounce back and even expand its range, causing environmental and economic damage, and rendering the initial eradication campaign redundant" (Rout et al., 2013). Although scientists try to predict the appropriate time to stop eradication programs, "imperfect detection methods make it difficult to tell whether an invasive species has been successfully eradicated" (Rout et al., 2013).

The "Vacuum Effect"

History has shown that the catch-and-kill method does not effectively reduce feral cat populations. Killing is a temporary, "quick fix" that may appeal to authorities but it does not stop the breeding cycle. When cats are trapped and removed from an area, new cats quickly move in to fill the vacated territory and start the breeding process all over again. This phenomenon was discovered by British biologist Roger Tabor and is referred to as the "vacuum effect" (Tabor, 1983). However, if a colony of cats is "neutered and returned to its area it will continue to hold the location and keep other cats out by its presence" (Tabor, 1995). The few new, unsterilized cats who may join the colony are also sterilized and returned.

The vacuum effect is perfectly illustrated by a study conducted by Lazenby et al. (2015) in the forests of Tasmania, Australia, where "low-level culling of feral cats" actually caused an *increase* in the number of cats in the area, despite the initial illusion that there was a decrease in population. Over the course of 13 months, researchers attempted to "simulate the resource-effort that typically might be availa-

ble to and expended by natural resource managers," which entailed trapping cats and shooting them in the head (Lazenby et al., 2015). At the end of the study, researchers noted a significant increase in feral cat numbers with an average of 75 percent at one site and 211 percent at the other site. It was also noted that "cat numbers fell, and were comparable with those in the pre-culling period, when culling ceased" (Lazenby et al., 2015). More importantly, the researchers acknowledge their efforts "did not constitute a sustained, multifaceted, long-term downward pressure on [their] study populations, which may be required if culling is to be used in programs of feral-cat control" (Lazenby et al., 2015). Subsequently, the catch-and-kill method of managing feral cats continues to prove ineffective.

Counterproductive

Eradication programs for feral cats can be highly counterproductive, with potentially catastrophic consequences on local ecosystems. As Dr. Niels Pedersen, Director of the Center for Companion Animal Health at the University of California- Davis, explains, "What people don't understand is that cats are the dominant carnivore in almost all human-oriented ecosystems... Every attempt to take cats out of the equation has led to disastrous ecological shifts as far as buildup of rodents as well as other over-populated species."

After cats were eradicated from Macquarie Island, near Antarctica, the rat population exploded, decimating the ground-nesting bird populations (rats feed on eggs and baby birds) (Strickland, 2009). Rabbits, too, increased in population, and destroyed the island's vegetation; this resulted in decreased materials for birds to build nests and left the native penguin population more susceptible to predators. Scientists spent seven years eradicating the rats, mice, and rabbits to combat their increased predation on birds (Strickland, 2009; "Lessons Learned from Devastating Effects of Cat Eradication on Macquarie Island," 2009). And on Wake Atoll, part of the Pacific Islands, a U.S. military base eradicated the cat population (though a few cats have since been sighted), which allowed for the rat population to dramatically increase. The base has been trying to control the rat population ever since.. Following a failed 2012 campaign to remove all the rats from the island via poisoned bait, a final attempt at total eradication was proposed in February 2022 (Mauser, 2022).

Marion Island provides yet another real-world example of why removing cats from an enclosed ecosystem does more harm than good to that ecosystem. After the 19-year long cat-culling campaign, the mouse population exploded and, as on Macquarie Island under the same circumstances, chicks of endangered bird species began falling prey to the mice (Clifton, 2018). Now, the same groups that wanted the island's cats eliminated to protect the seabirds are calling for the extermination of all mice from Marion through the "Mouse-Free Marion Project " (Saving Marion Island's Seabirds, acessed 2022).

Other counterproductive eradication attempts include: the explosion of the local rat population in Albany, Ore., after "aggressive city efforts in recent years to control the feral cat population" (KOIN 6, 2013), and an increase in the local skunk population in Cape May, N.J., following the removal of a colony of feral cats (Cox, 2008)." An eradication effort on Little Barrier Island near New Zealand resulted in a proliferation of rats, who then preyed on the petrels meant to be protected from cats (Rayner et al., 2007).

In a letter to *Nature,* biologists Kevin R. Crooks and Michael E. Soulé explain that when large mammalian carnivores disappear (or in the case of eradication programs, they are lethally removed), small carnivores, or meso-predators, increase

(Crooks and Soulé, 1999). In other words, when a top predator, such as the cat, is removed from the food chain, smaller predators like rats — along with prey animals like rabbits — increase in abundance, which is often bad news for an ecosystem. As seen on Macquarie Island, removal of the top predator (cat) left prey populations (rats and rabbits) unchecked and vegetation was decimated, causing the entire ecosystem to collapse.

Costly and Very Time-Intensive

Eradicating feral cats is a futile endeavor that comes with a hefty price tag — at the expense of the taxpayer — and requires decades of continual killing. It took over 15 years and cost AU$3.5 million (about $2.5 million USD) to eradicate the 2,500 cats on Macquarie Island (which is only 21 miles long and 3 miles wide), with another AU$24.7 million (about $20.2 million USD) allocated to eradicating the rats and rabbits over seven years (Veitch et al., 2011). Marion Island near South Africa is only 15 miles long and 10 miles wide, yet it took 19 years to kill 3,400 cats (Bester et al., 2002). The now necessary "Mouse-Free Marion Project" is expected to require another $2.1 million ("Sponsor a Hectacre"). Additionally, it cost $1.3 million to eradicate the cats living on Ascension Island (located in the South Atlantic Ocean), which is only 34 square miles (Veitch et al., 2011). These eradication programs that are deemed "successful" within the scientific community have been carried out on small, isolated islands with little to no human habitation. Attempting to eradicate an entire population of feral cats on a continent, with far more variables and unpredictable outcomes, would be impossible.

Cruel and Inhumane

Along with being ineffective and costly, eradication programs are also cruel to the animals being culled. In many cases, the animals die slow, painful deaths due to asphyxiation, starvation, dehydration, dismemberment, or over-exposure to weather elements. Killing methods used for feral cats include poisoned bait, cage traps, leghold traps, shooting, gassing, drowning, hunting with dogs, and exposure to deadly viruses. One method used in Australia lured cats into tunnels where they were sprayed with a toxic substance (Murphy et al., 2011).

The country's government has also been working to create a deadly virus to be released nationwide to control the feral cat population, along with producing a toxic bait known as "Curiosity" (Owens, 2014; Arup and Phillips, 2014) and an robot called a Felixer, which identifies passing cats by their size and speed and then sprays the cats with a toxic gel (Science X, 2020).

In the above island examples, every eradication program required more than one method of killing to eliminate most or all of the feral cats. On Marion Island, nearly 100 cats were intentionally infected with the feline panleukopenia virus (feline distemper), which ultimately killed around 2,800 cats. Some cats, however, built up an immunity to the disease, so the remaining individuals were shot at night (Bester et al., 2002). On Ascension Island, the cats were killed by live trapping and shooting, poisoned bait, and leghold traps (Ratcliffe et al., 2010). One study of 87 island eradication programs, including Macquarie Island, revealed that "on average, each campaign employed 2.7 eradication methods including leg-hold traps (68%), hunting (59%), primary poisoning (31%), cage traps (29%), and dogs (24%)" (Ratcliffe et al., 2010).

Collateral Damage

Eradication programs rarely kill only the intended species; more often, many non-target animals are killed as well. Poisoned bait does not discriminate between a cat

Perpetual Killing

Australian Environmentalist Frankie Seymour explains that: "Reducing a population of mislocated animals is a complete waste of time (and money) unless you are prepared to keep on reducing it—killing and killing and killing, generation after generation. The moment you turn your back for a year or a season, the population will return to full occupation of all available niches."

Seymour also points out that "when you kill animals to control their numbers, you are constantly culling for individuals who are clever or fast or strong enough to thwart your attempts to kill them—and they pass those faster, smarter, stronger genes (as well as their experiential knowledge) on to their offspring. This is basic Darwinianism—survival of the fittest—yet the thought of it does not seem to have entered the heads of those who advocate lethal control of 'feral' animals" (Seymour, 2006).

and another meat-eating animal, and intentionally unleashed viruses like, feline distemper, infect feral cats and domestic cats alike. In these programs, when live-trapped cats show no sign of ownership (i.e., a collar or microchip) they will be killed even if they are someone's pet.

Non-target animals sometimes pay quite a high price when people try to eradicate cats. On Ascension Island, 38 percent of domestic house cats were killed, causing "public consternation" (Ratcliffe et al., 2010). Over 6,000 land crabs were also killed by ingesting poisoned bait, and "a moratorium on crab claw consumption" was implemented to prevent secondary poisoning of humans (Ratcliffe et al., 2010). In some cases, eradication of feral cats is done through secondary poisoning, meaning prey animals are intentionally poisoned in order to kill cats who eat the tainted prey. On the New Zealand island of Tuhua, cats were removed through secondary poisoning by attempting to eradicate two types of rats living on the island (Ratcliffe et al., 2010).

Even on Marion Island, where "acceptable" numbers of non-target animals were killed, hundreds of birds died in traps set for cats, including some of the petrels that the eradication of cats was meant to protect (Bester et al., 2000). After most or all of the cats had already been killed, researchers set out 30 thousand slaughtered chicken carcasses that had been laced with poison across the island. There is no record of how many cats or other animals died from consuming these tainted birds (Bester et al., 2000).

Perpetuates Animal Abuse

When policies support lethal methods of control, it sends a message to the public that it is morally acceptable to kill sentient beings. Humans created the situation that feral cats are currently in: we domesticated them, we relocated them to every corner of the Earth, and we allowed them to reproduce. Therefore, it is our responsibility to manage them humanely. Killing is the highest form of abuse; it is certainly not humane.

Feeding Bans

Some authorities blame caregivers for perpetuating and even starting the problem by feeding stray and feral cats. They think the cats can be "starved out," so they implement feeding bans and threaten anyone caught feeding outside cats with fines and jail time. These plans never work because cats are territorial animals who won't quickly abandon an area, and they are also very resourceful scavengers, finding new food sources even when supplies are scarce. In addition, compassionate people continue to feed outdoor cats regardless of

potential fines and other repercussions; it seems to be a natural act for humans to feed an animal to keep her from starving. One recent study concluded that as much as 25 percent of U.S. households, approximately 30 million, are feeding at least one community cat (Lord, 2008). Instead of blaming feeders/ caretakers and criminalizing their actions, we should encourage their acts of compassion by assisting them with the resources and information to help sterilize the animals.

Conclusion

TNR programs are highly effective in stabilizing feral cat populations, reducing shelter costs and euthanasia rates, and improving the overall health of outdoor cats. In a proper TNR program, all kittens and adoptable adult cats are immediately removed and placed into adoption programs, which decreases a colony's size instantly. All remaining cats are sterilized to stop the breeding cycle. Euthanizing cats who are too sick or injured to be helped also decreases the number of cats in a colony, and, over time, natural attrition will further reduce the size of a colony.

When feral cats enter a traditional shelter they are usually euthanized immediately. Most agencies do not have the time nor the resources to house feral cats. However, by working with local rescue organizations to implement TNR programs, fewer cats end up in shelters, fewer cats are killed, and the feral cats who do come in can be returned to their appropriate colony.

The traditional method of controlling feral cats by catching and killing them is not only outdated, it has been proven ineffective, counterproductive, and costly. The few examples scientists like to provide of "successful" cat eradication programs took several years, millions of taxpayer dollars and were carried out on tiny islands, most uninhabited by humans. Removing the cats in these examples also increased prey populations of rats and rabbits, so eradication programs were implemented to remove those animals , which were harming the ecosystem, as well. Once you start killing, you have to continue to kill until all targeted animals are removed or the breeding cycle will repopulate the area.

TNR provides a practical solution with a more subtle way of interacting with the en vironment. TNR stops the breeding cycle without removing the existing animals from the ecosystem. This does not create any open niches and keeps nature in balance. Professor Andrew Linzey of the University of Oxford, England, once said:

> In the name of biodiversity, these 'managers' regularly kill one form of life in order to 'allow' another to survive ... perhaps populations rise and crash as a matter of course ... we seem to have forgotten ... that it is a self-regulating system. (Linzey, 2001)

With more individuals sharing their homes with companion animals, the bond between humans and animals is strengthening. People are making more compassionate decisions and becoming more vocal regarding animal concerns. And they are awakening to their place within the environment and moving away from the view that humans are separate from the environment. The public no longer finds it morally acceptable to use lethal animal management practices, such as catch-and-kill. Today's society supports programs that preserve and respect life, like TNR.