FERTILITY CONTROL IN URBAN DEER: QUESTIONS AND ANSWERS

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Dr. Warren began conducting research on wildlife fertility control in 1985. Since then, he has evaluated the use of immunocontraceptive vaccines on feral horses on Cumberland Island, GA; immunocontraceptive vaccines on captive deer and horses, contraceptive implants in captive deer, contragestation in captive deer, and the application of contragestation to wild deer herds in Minneapolis, MN and Kiawah Island, SC.

**PURPOSE:**
Recently, the public and news media have shown an interest in the use of fertility control for managing overabundant deer herds in urban and suburban areas. Often this interest leads to a debate about using these non-lethal methods in place of traditional methods like hunting. The debate is usually fueled by misunderstandings about the current research on wildlife fertility control and its availability, as well as the distinction between controlling fertility in an individual deer versus an entire population. This document examines the more common questions raised about fertility control in urban deer and provides a factual basis for evaluating the potential use of fertility control as a method of deer population management.

This document summarizes the best available scientific information on fertility control in urban deer.

**QUESTIONS & ANSWERS:**

**What methods are available for controlling fertility?**
Currently, there are several proven methods of controlling fertility in individual deer. Details on these methods are presented in the technical publications listed at the end of this document under “Sources of Literature.” Most research has focused on controlling fertility in females because of the greater potential for controlling populations of free-ranging deer. These methods can generally be grouped as follows:

### Surgical sterilization
This method is permanent but has limited applicability to herd management because it requires capturing individual deer and using field surgery.

### Synthetic steroid hormones
These methods usually prevent ovulation or conception. Orally administered hormones work in penned deer as long as their feed is treated daily. These hormones don’t work in free-ranging deer because it is not possible to ensure daily exposure to the hormone. Implants containing the hormone and placed under the skin have blocked fertility in deer for 1-2 years. Use of synthetic steroid hormones in free-ranging deer may affect non-target species (including humans) which consume venison from treated deer. Currently, no synthetic steroid hormones have been approved or registered by federal or state agencies for routine use in free-ranging deer.

### Immunocontraceptive vaccines
These methods cause infertility similar to how animals develop immunity against diseases. Immunocontraceptive vaccines contain protein hormones (for example, GnRH) or the protein-coating around cells (for example, PZP) that are important to reproduction. After a deer is injected with an immunocontraceptive vaccine, its immune system forms...
Abortion-inducing hormones
These methods control fertility in deer by terminating pregnancy. At least one commercially available product, prostaglandin, has been approved and registered by federal or state agencies for use in various domestic animals (including livestock that are consumed by humans) for terminating pregnancy. However, prostaglandin has not yet been approved for routine use in free-ranging deer.

Contraception means to prevent conception by either stopping ovulation or fertilization. Contraception is usually temporary. Fertility often returns after treatment is stopped. Sterilization means to be unable to reproduce and usually refers to permanent infertility.

Contraception refers to all methods of inhibiting reproduction (contraception, sterilization, and contragestation).

What is the difference between contraception and fertility control?
Contraception means to prevent conception by either stopping ovulation or fertilization. Contraception is usually temporary. Fertility often returns after treatment is stopped. Sterilization means to be unable to reproduce and usually refers to permanent infertility.

Contragestation means to prevent gestation or pregnancy after conception (for example, an abortion). Fertility control is used collectively to refer to all methods of inhibiting reproduction (contraception, sterilization, and contragestation).

If there are methods to effectively control fertility in individual deer, then can’t we also control free-ranging deer populations?
No. There is a lot of research demonstrating the effectiveness of fertility control methods in individually treated deer; however, there is currently no evidence supporting their effectiveness in controlling deer populations. Proving the effectiveness of fertility control methods in individual deer and controlling the growth of an entire deer population are two distinctly different problems.
The PZP must be mixed with FCA to form the PZP vaccine. When this vaccine is injected into a doe, her immune system forms antibodies against the PZP. These PZP antibodies also recognize and attack the doe’s own ZP. After the doe ovulates, the PZP antibodies attach to her ovum and block fertilization. Although it is possible to synthetically produce the ZP protein, to date these synthetic forms have not been as effective as the natural protein from pigs.

How long does PZP cause infertility?
The current form of PZP vaccine causes infertility for about 1 year. A booster shot is required each year to maintain infertility. Research is currently underway with different forms of immunocontraceptive vaccines that may be effective for more than 1 year.

Is it possible to develop a “one-shot” PZP vaccine so a doe doesn’t have to be vaccinated twice during the first year?
One disadvantage of the PZP vaccine is that two shots must be given at least 2-3 weeks apart during the first year of treatment. Researchers have experimented with micro-encapsulated (covered with a protective chemical coating) forms of the PZP vaccine in the hopes of developing a “one-shot” PZP vaccine. Basically, this kind of injection contains two forms of the PZP vaccine—one that is free and immediately exposed to the immune system; the other form is micro-encapsulated so it will not be “released” into the animal’s system for a few weeks after injection. Theoretically, one could administer the initial and booster shots at the same time. To date, the research conducted has not been successful, primarily because of the difficulty of micro-encapsulating the complex protein mixture that is in the PZP vaccine. A variation on this idea is to capture female fawns and inject them with the first PZP vaccine. The vaccination they then receive the next year represents their booster shot. Another variation is to administer the first vaccine during the winter when deer are easily attracted to bait stations, and then administer the booster shot during the following fall before breeding. Research in these novel methods of timing the injection of PZP vaccines is currently underway.

Does PZP treatment affect the doe’s behavior?
Yes and no. Deer are seasonal breeders. The decreasing amounts of daylight in the fall cause them to breed. Usually beginning in October, a doe will come into heat or estrus about every month until she becomes pregnant. A doe’s breeding behavior is not affected by PZP treatment. She will behave normally and breed when she comes into estrus, but the PZP treatment prevents fertilization. Therefore, she cannot become pregnant and will continue coming into heat every month for several months until the amount of daylight again increases. Thus, a PZP-treated doe may still be in heat as late as April or May, which is not normal behavior for most deer. The long-term effects of multiple heat cycles on deer are currently unknown.

Will treating does with PZP affect the behavior or survival of bucks in a herd?
Yes and no. Research has shown that bucks will continue breeding or rutting for longer periods. Because PZP-treated does continue cycling, the bucks continue rutting for several months. Interestingly, survival of bucks generally is not reduced by the prolonged rut. Research has shown that the dominant bucks which breed earlier in the breeding season quit breeding after a few months. Thereafter, subordinate bucks in the herd continue breeding the does that come into heat later in the prolonged breeding season. The long-term effects of this shift in breeding on deer are currently unknown.

Does extending the rut by using PZP vaccine present any concerns for human safety?
We don’t know. Deer are known to be more active and bucks are more aggressive during rut than other times of the year. It is also known that the incidence of deer-vehicle collisions increases during the rut. Will prolonging the rut also prolong the period of the year with the highest incidence of deer-vehicle collisions? Field research is needed to answer this question.

If a doe is treated after she is already pregnant, will PZP treatment affect her fetus?
No. Treatment of pregnant does with PZP vaccine has not interfered with normal pregnancy and fawning. PZP treat-
ment specifically affects the ovum and not the fetus. To date no research has been conducted on whether or not blood exchange between a doe and its female fetus may affect the ovaries of the fawn after it is born.

**Will treating does with PZP affect behavior or survival of fawns in a herd?**

Yes and no. Recent research has shown that some PZP-treated does become pregnant later in the breeding season after their PZP antibody levels drop. By conceiving in late winter or spring, these does give birth to their fawns in late summer or fall. Late-born fawns appear to be normal behaviorally, but they may not have enough time to grow and accumulate fat reserves before winter. A deer that does not have enough fat reserves may starve during winter in those geographic areas that have severe winter conditions. Therefore, overwinter survival for any late-born fawns from PZP-treated does may be lower than for fawns from untreated does.

**Is it safe to eat venison from a doe treated with PZP vaccine?**

We don’t know. To date, research has not been conducted to answer this question. Most vaccines are not orally effective. The digestion in the stomach and intestine probably breaks down the proteins in most vaccines so that they are absorbed in an inactive form. The U.S. Food and Drug Administration (FDA) is the primary regulatory agency that must approve vaccines before they can be registered as safe for use in animals consumed by humans. To date, FDA has not registered PZP vaccines as being safe for use in deer that might be consumed by humans. In fact, FDA has expressed concerns about the Freund’s Complete Adjuvant (FCA) used in some forms of PZP vaccine. There are synthetic adjuvants available that FDA has registered for use in human food animals, but preliminary research has shown they are not as effective in the PZP vaccine as FCA.

**Is it safe to eat venison from a doe treated with steroid hormones or prostaglandin?**

FDA has not registered synthetic steroid hormones as being safe for use in deer that might be consumed by humans. Prostaglandin hormones have been approved by FDA as safe for use in several domestic species consumed by humans for food, because of no detectable residues in meat. However, prostaglandin hormones have not yet been registered by FDA for use in deer.

**Why does the PZP vaccine have to be injected? Are there not any other methods of administration?**

They must be injected in order to bypass digestion in the stomach and intestines. Some researchers are trying to develop an orally effective form of the vaccine by linking it to bacteria or viruses, but this research is at the very early stages. Orally effective immunocontraceptive vaccines may affect non-target species; therefore, approval from FDA and other federal and state environmental protection agencies would be required.

**What is the “biobullet” and how is it used in wildlife fertility control?**

Biobullet is short for biodegradable bullet. The biobullet is made of highly compressed paper (cellulose) and other chemicals. It has a hollow interior, into which freeze-dried hormones or vaccines can be added. The biobullet is shot from a specially designed air rifle to implant the biobullet about 1 inch into the hindquarter of a deer. The biobullet dissolves in the muscle and releases the hormone or vaccine. The biobullet is an alternative to syringe-darts for remotely treating deer. Syringe-darts must be used to inject liquids. For example, the PZP vaccine with FCA is currently available only in liquid form.
Is it possible for a deer to develop resistance to the PZP vaccine?
No. It is unlikely that deer would develop resistance to the PZP vaccine. Some individual deer respond better to the PZP vaccine than others; as a result, they develop higher antibody levels after injection than other individuals. In these does, infertility may develop sooner and last longer. Infertility depends on the level of antibodies that develop after injection.

Is it possible for PZP vaccination to adversely affect other proteins in a doe or otherwise cause her pain or discomfort?
The antibodies produced by the immune system after injection with a PZP vaccine are specific to the ZP protein around the ovum. Other proteins in the deer’s body are not recognized, and hence are unaffected, by the PZP antibodies. Some does treated with PZP vaccines develop abscesses at the site of vaccination. These abscesses are usually small puss-filled swellings in the muscle or beneath the skin and could cause some pain and discomfort.

How costly is it to purchase fertility chemicals, and how much are labor costs to use them?
The cost of the hormone or vaccine is relatively low. Even the current form of the experimentally produced PZP vaccine costs only about $20 per deer. However, the primary cost associated with the use of such methods for urban deer control is that of hiring people to treat the deer. Those costs vary with the difficulty of treating deer. As the proportion of treated does in a herd increases, the time needed to find untreated does in the herd also increases. Thus, labor costs would be higher as more does in the herd are treated. Labor costs are higher still if does have to be live captured and marked before treatment. In one study in a suburban Ohio park, the total cost of using PZP vaccine in live-captured deer was $1,100 per treated doe.

Because unmarked deer in a herd run the risk of being treated multiple times with a hormone or vaccine, are there any dangers from receiving multiple doses?
Research to date has shown no risk to a doe that may be treated repeatedly with either PZP vaccine or prostaglandin hormone. The doe would simply receive an extra, unnecessary booster shot in the case of PZP. Similarly, the prostaglandin hormone only affects pregnancy, and once pregnancy is terminated, further effects are not possible. Conversely, repeated exposure to synthetic steroid hormones would pose a possible danger to the doe because these chemicals are known to accumulate in body tissues.

Is there no easy method of marking treated deer to avoid multiple treatments?
Currently there is no easy, proven method of marking deer without capturing them first. Capture efforts are costly and stressful to the deer. Preliminary research has been conducted with a “marker dart” that would simultaneously inject a doe with PZP vaccine and mark her coat with a spot of paint. The paint from these marker darts would temporarily mark the doe and may last for the few weeks during which does are being vaccinated in a herd. Temporary markings can only be used in isolated or penned deer. FDA requires all free-ranging, PZP-treated deer to be marked with ear tags or collars warning that they are unsafe for human consumption.

Who will pay the cost of managing urban deer herds with fertility control?
Most deer contraceptive and fertility control projects conducted to date have been funded by local cities or neighborhoods. At present, most state fish and wildlife agencies do not receive funding from state legislatures or federal agencies to conduct this type of work. The U.S. Department of Agriculture has expanded research on wildlife fertility control. Most cities considering the use of deer fertility control must provide funding and first receive special permits from FDA and their state’s fish and wildlife agency. Most often, such work must be justified as an experimental research project. Currently, no fertility control methods can be applied to urban deer without these special permits.
Will the use of fertility control affect the genetic diversity of the deer herd?
Research has not been conducted to answer this question. However, among mammals, the white-tailed deer is one of the most genetically variable species. Therefore, fertility control probably would not affect the genetic diversity of a deer herd. Even if this effect did occur, it is possible to increase the genetic variability of a herd by introducing deer from other areas.

Will treatment of a doe with fertility control methods affect her health and well being?
Probably not, because these fertility control methods have been safe to the treated individuals. Indeed, by being infertile, a doe may be healthier. Pregnancy and lactation are nutritionally demanding for the doe. By not having a fetus or fawn to nourish, the doe will save nutrients and, as a result, should be better nourished herself.

Would fertility control methods possibly be more effective if applied to isolated or confined deer herds?
Yes. Fertility control probably would be most successful if applied in isolated or confined areas with fewer than 100 deer. It is more practical to treat fewer does. Also, immigration of deer from surrounding areas is probably less in isolated or confined herds compared to free-ranging deer.

One buck can breed with many does. Would it not be more efficient to treat bucks with fertility control methods rather than does?
No. It is not more efficient to treat bucks instead of does. A doe can breed with more than one buck. Therefore, it would be necessary to treat all of the bucks in the herd to prevent pregnancy in the does. Even just one fertile buck in the population could successfully breed many does.

Are these fertility control methods readily available from commercial sources and is it legal to use them?
Yes and no. Steroid and prostaglandin hormones are currently produced commercially and readily available. However, FDA has neither approved nor registered these fertility control methods for use in free-ranging white-tailed deer. Currently, there is neither a commercially produced source for PZP vaccines, nor has this method been approved or registered by FDA for use in free-ranging deer.

Are there any estimates as to how many does in a herd would have to be treated to control the population’s growth?
Field research is currently underway to answer this question. Past work done with computer models to simulate birth rates, death rates, nutritional condition, population density, and effectiveness of fertility control has predicted that about 70% or more of the does in a herd would need to be treated before growth of the population might be controlled. In the field, as land area and deer densities increase, the number of does to be treated will also increase, thereby affecting the cost and practicality of a fertility control program. It may be practically impossible to treat enough does in free-ranging deer herds to decrease their population numbers.

If fertility control is used in urban and suburban areas where the deer herd is already overabundant, about how long will it take for the population to be noticeably lower?
Results from computer simulations show that the time required for a deer population to be lowered by fertility control alone depends on many factors—mortality in the herd, immigration into the area, percentage of treated females in the herd, nutritional condition and reproductive rates in the untreated does, etc.

Generally, most computer-generated estimates have predicted that it may take 5-20 years before deer numbers decrease.

Preliminary results on the effect of PZP vaccine on deer population numbers are available from an ongoing field study in New York. Each year from 1993 to 1998, between 70 and 200 does/year out of an estimated 300 does in the herd were treated with PZP vaccine. Fawning rates for these PZP-treated does decreased by about 90%, but the number of deer in the herd did not decrease.
Sources of Literature


McLvor, D. E., and R. H. Schmidt. 1996. Annotated bibliography for contraceptive methods, approaches, and policy. Berryman Institute, Department of Fisheries and Wildlife, Utah State University, Logan, Utah, USA.


