

ENVIRONMENTAL ASSESSMENT

Managing Damage and Threats Associated With Invasive Patas and Rhesus Monkeys In the Commonwealth of Puerto Rico

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ACRONYMS

AC	Animal Care
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
AWA	Animal Welfare Act
BO	Biological Opinion
CDC	Centers for Disease Control and Prevention
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species
DEA	U.S. Drug Enforcement Agency
DNER	Department of Natural and Environmental Resources
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FDA	United States Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
INAD	Investigational New Animal Drug
IWDM	Integrated Wildlife Damage Management
JAVMA	Journal of the American Veterinary Medical Association
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIH	National Institutes of Health
NIOSH	National Institute for Occupational Safety and Health
NWRC	National Wildlife Research Center
OTA	Office of Technology Assessment
PRDA	Puerto Rico Department of Agriculture
SOP	Standard Operating Procedure
T&E	Threatened and Endangered Species
TSR	Trap, Sterilize, and Release
U.S.	United States
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFWS	U.S. Fish and Wildlife Service
WS	Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

Across the world, as human populations have expanded, wildlife species have been introduced into new areas, and land has been transformed to meet human needs. These changes often increase the potential for conflicts between wildlife and people that result in damage to resources and threaten human health and safety. One encroachment on native ecosystems is the introduction of non-native, invasive species into naïve environments. Invasive species often compete with native plants and wildlife and can threaten biodiversity. The number of invasive species introduced in the history of the United States (U.S.) has been estimated at 50,000 species (Pimentel et al. 2005). Some introduced invasive species benefit society, such as corn, wheat, cattle, poultry, and other food items. Nearly 98% of the food system in the U.S. is derived from introduced, invasive species (USBC 2001, Pimentel et al. 2005). Other invasive species have caused considerable economic and environmental damage in the U.S. and worldwide. Pimentel et al. (2005) estimated invasive species cause nearly \$120 billion in environmental damages and losses in the U.S. annually. Of particular concern are the impacts of invasive species on threatened and endangered (T&E) species worldwide. Invasive species negatively impact nearly 42% of the species listed as T&E in the U.S. (Wilcove et al. 1998, Pimentel et al. 2005). Worldwide nearly 80% of wildlife populations at risk of extinction are threatened or negatively impacted by invasive species (Pimentel et al. 2005).

Some species of wildlife, including invasive species, have adapted to and thrive in human altered habitats. These species, in particular, are often responsible for the majority of conflicts between humans and wildlife that lead to requests for assistance to reduce damage to resources and to lessen the threat to human safety. The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services' (WS)¹ programmatic Final Environmental Impact Statement (FEIS) summarizes the relationship of wildlife values and wildlife damage in this way (USDA 1997)²:

“Wildlife has either positive or negative values, depending on varying human perspectives and circumstances...Wildlife is generally regarded as providing economic, recreational and aesthetic benefits...and the mere knowledge that wildlife exists is a positive benefit to many people. However... the activities of some wildlife may result in economic losses to agriculture and damage to property...Sensitivity to varying perspectives and values are required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well”.

With this said, both sociological and biological carrying capacities must be applied to resolve wildlife damage problems. The wildlife acceptance capacity, or cultural carrying capacity, is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations. Biological carrying capacity is the land or habitat's ability to support healthy populations of wildlife without degradation to the species' health or their environment during an extended period of time (Decker and Purdy 1988). These phenomena are especially important because they define

¹ The WS program is authorized to protect agriculture and other resources from damage caused by wildlife through the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c). WS' mission, developed through its strategic planning process, is to provide leadership in wildlife damage management in the protection of agricultural, industrial and natural resources and to safeguard public health and safety. WS' activities are conducted to prevent or reduce wildlife damage to agricultural resources, natural resources, property, and threats to public health and safety on private and public lands in cooperation with governmental entities and local agencies, private organizations, and individuals (See Appendix B for more detail).

² WS' FEIS may be obtained by contacting USDA/APHIS/WS, Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

the sensitivity of a community to a wildlife species. For any given damage situation, there are varying thresholds of tolerance exhibited by those directly and indirectly affected by the species and any associated damage. This damage threshold determines the wildlife acceptance capacity. While the habitat may have a biological carrying capacity to support higher populations of wildlife, in many cases the wildlife acceptance capacity is lower or has been met. Once the wildlife acceptance capacity is met or exceeded, people begin to implement population or damage management, including lethal methods, to alleviate damage or address threats to human health and safety.

The alleviation of damage or other problems caused by or related to the behavior of wildlife is termed wildlife damage management and is recognized as an integral component of wildlife management (The Wildlife Society 1992). Wildlife damage management is not based on punishing offending animals, but is a means to reduce future damage. The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated and the need for damage management is derived from the specific threats to resources. These species have no *intent* to do harm. They utilize habitats (*i.e.*, reproduce, walk, forage, deposit feces) where they can find a *niche*. If their activities result in lost economic value of resources or threaten human safety, people characterize this as damage.

An adaptive Integrated Wildlife Damage Management (IWDM) approach is often employed to resolve wildlife damage or threats to human safety, where a combination of methods may be used or recommended to resolve the damage or threat. Adaptive IWDM is the application of safe and practical methods for the prevention and reduction of damage caused by wildlife based on local problem analyses (Slate et al. 1992) and the informed judgment of trained personnel. Adaptive IWDM is a site-specific strategy to evaluate each damage situation and devise a management approach to resolve/alleviate the damage in the most effective and environmental friendly manner. Adaptive management may require the modification of human or animal behavior, or that wildlife identified as causing damage are removed or that local populations or groups are reduced through lethal methods. Potential environmental effects resulting from the application of various monkey damage management techniques are evaluated in this Environmental Assessment (EA) (See Appendix D for a description of potential methods).

WS, the Puerto Rico Department of Natural and Environmental Resources (DNER), the Puerto Rico Department of Agriculture (PRDA), and the U.S. Fish and Wildlife Service (USFWS) are preparing this EA to: 1) facilitate planning, interagency coordination, and the streamlining of program management; 2) clearly communicate to the public the analysis of individual and cumulative impacts of program activities; and 3) evaluate and determine if there are any potentially significant or cumulative adverse affects from the proposed program. All invasive monkey damage management conducted in Puerto Rico is undertaken in compliance with relevant laws, regulations, policies, orders, and procedures, including the Endangered Species Act (ESA) of 1973, as amended. The EA has been reviewed by USDA, APHIS, Animal Care (AC) for compliance with the Animal Welfare Act (AWA). This analysis relies on existing data contained in published documents (Appendix A), site specific information from officials in Puerto Rico, information from the USFWS, WS' programmatic FEIS (USDA 1997), and review and comment by AC. Information from WS' programmatic FEIS is incorporated by reference into this EA.

1.2 PURPOSE OF THE EA

The purpose of this EA is to evaluate activities conducted by WS, DNER, PRDA, and the USFWS to manage damage and threats associated with invasive monkeys, specifically damage to agriculture, property, natural resources, and threats to humans caused by patas (*Erythrocebus patas*) and rhesus monkeys (*Macaca mulatta*) in the Commonwealth of Puerto Rico. Changes in the affected environment have prompted WS and cooperating agencies to initiate this new analysis. One purpose of this EA is to address these more recently identified changes and to assess the potential environmental impacts of

program alternatives, based on the most recent information available. In addition, this EA will assist in determining if the proposed management of invasive monkey damage could have a significant impact on the environment for both humans and other organisms, analyze other alternatives, coordinate efforts, inform the public, and to comply with the National Environmental Policy Act (NEPA). This EA analyzes the potential effects of invasive patas and rhesus monkey damage management, as coordinated between WS, the DNER, the PRDA, and the USFWS, to include other governmental agencies, and private entities, as appropriate, in Puerto Rico under Memorandum of Understanding (MOU), cooperative service agreement, or other comparable document. The EA also addresses the effects of monkey damage management on areas where additional agreements may be signed in the future. Because the proposed action is to conduct a coordinated approach between cooperating agencies to managing damage associated with invasive monkeys in accordance with plans, goals, and objectives developed by WS, DNER, PRDA, and USFWS to reduce damage, and because the goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates these additional efforts and the analyses are intended to apply to actions that may occur in any locale and at any time within Puerto Rico as part of a coordinated approach between cooperating agencies.

The purpose of patas and rhesus monkey damage management in Puerto Rico, under the policies of WS, DNER, PRDA, and the USFWS is to minimize human health and safety risks, and damage to agriculture, property, and natural resources. WS' involvement in invasive monkey damage management along with the DNER, PRDA, and the USFWS provides residents of Puerto Rico swift and more effective services to address damage and threats associated with invasive monkeys. Under the proposed action, monkey damage management could be conducted under cooperative service agreements, MOU, or other comparable documents on private, U.S. government, Commonwealth, and municipal lands in Puerto Rico, upon request for assistance or on lands owned or managed by the cooperating agencies.

1.3 NEED FOR ACTION

As stated previously, approximately 50,000 invasive (non-native) species have been introduced into the U.S., including Puerto Rico (Pimentel et al. 2000, Pimentel et al. 2005). Beneficial impacts to society and economic gains can be derived from invasive species, especially those used and cultivated for human consumption. However, many invasive species, when introduced into a naive environment, can cause significant economic and environmental damage. The introduction or release of invasive wildlife and plants into naive ecosystems often has harmful consequences on native flora and fauna (Witmer et al. 1996, Pimentel et al. 2000, Long 2003, Pimentel et al. 2005, Witmer et al. 2005). The Office of Technology Assessment (OTA) (1993) reported that 79 invasive species in the U.S. had caused an estimated \$97 million in damage from 1906 to 1991. Negative economic and environmental impacts are especially true if the invasive species exhibit generalist behaviors to which the native flora or fauna are not adapted, as is the case on many islands. Thus, invasive species have been identified as the primary cause of endangerment of at least 40% of the species listed as threatened or endangered in the U.S. (Wilcove et al. 1998, Pimentel et al. 2000, Pimentel et al. 2005).

Non-human primates have been traded in the Caribbean for more than 300 years due to commerce with West Africa and the establishment of primate research facilities. As a result of this trade and research, several Caribbean Islands have had introduced populations of monkeys. The vervet or green monkey (*Chlorocebus aethiops*) was imported onto St. Kitts, Nevis, Barbados, and possibly St. Eustatius (Denham 1987). The mona monkey (*Cercopithecus mona*) has become established in Grenada (Denham 1987). During the last 30 years, three species of non-human primates have escaped captivity from primate research facilities and have become established in Puerto Rico and surrounding islands. These are the

rhesus macaque³, patas monkey, and squirrel monkey (*Saimiri sciureus*). Rhesus macaques and patas monkeys became established in Puerto Rico after escaping from the La Parguera Primate Breeding Colony, which was established as a primate research facility on the islets of Cueva and Guayacán, part of the Boquerón Commonwealth Forest in the 1960s (Vandenbergh 1989, González-Martínez 1995).

The importation of monkeys into Puerto Rico for research purposes first began in the late 1930s. In November 1938, 409 rhesus macaques from India were delivered to the Islet of Santiago off the coast of Puerto Rico to study the ecology of free-ranging rhesus macaques. A research facility now exists on the Islet of Santiago for the study of free-ranging rhesus macaques (Rawlins and Kessler 1986, Southwick 1989). In 1961, another facility, the La Parguera Primate Breeding Colony, was established for the production of rhesus macaques for research purposes on the islets of Cueva and Guayacán (Kerber et al. 1979). The La Parguera primate facility was operating under National Institute of Health (NIH) funding and was administered by the Caribbean Primate Research Center of the University of Puerto Rico beginning in 1970. Macaques from India and from the islet of Santiago were imported to establish a colony on the islets of Cueva and Guayacán as part of the La Parguera facility (Vandenbergh 1989, González-Martínez 1995, González-Martínez 2004). However, shortly after being released on those islets there was evidence that rhesus monkeys were escaping from the breeding colony (González-Martínez 1996, González-Martínez 2004). In 1966, a population of 57 rhesus macaques was introduced on the island of Desecheo. The Desecheo primate ecology project was terminated in 1971. The Caribbean Primate Research Center of the University of Puerto Rico was established in 1970 in Sabana Seca (this is where the squirrel monkeys escaped).

Between 1971 and 1972, patas monkeys were released on the islet of Cueva to provide an additional primate species for use in medical research (rhesus macaques were already present on the islet) and to more adequately utilize the resources on the island to study a second species (Loy 1989). Patas monkeys were later introduced on the islet of Guayacán. Shortly after the release of patas monkeys on the islet of Guayacán, there were reports of monkeys leaving the islet for the Puerto Rico mainland. When the La Parguera facility was closed in 1982 there were approximately 54 patas monkeys missing (González-Martínez 2004).

In the early 1990s, González-Martínez (1995) estimated the size of the patas population to be approximately 120 individuals, with their distribution thought to be within a 125 km² area of southwestern Puerto Rico. This area included Sierra Bermeja, and adjacent parts of Lajas and Cabo Rojo. González-Martínez (1995) estimated the population of rhesus monkeys to be 130 individuals divided into two groups in southwest Puerto Rico. The population of rhesus monkeys in the Sierra Bermeja area consisted of 65 to 85 individuals with the second population located near San German consisting of 40 to 45 individuals (González-Martínez 1995). Each species had preferred habitats within their core ranges.

González-Martínez (1995) did not believe the primates were impacting the native habitats to a significant degree, agricultural damage was exaggerated, and that neither species of monkey could be eradicated. However, if Puerto Rican monkey populations are allowed to increase in density and range, there is the potential for significant environmental and agricultural problems (Evans 1989, González-Martínez 1996, González-Martínez 2004). González-Martínez (1996) further recommended that additional dispersal and population expansion be prevented and that the population size be reduced.

Today, invasive patas and rhesus monkey numbers are estimated to be much higher than the numbers estimated in the early 1990s. Jensen et al. (2004), estimate the rhesus monkey population to be around 500 individuals based on the assumption that food resources are plentiful and that the population growth rate is 15% annually. The DNER estimated the rhesus monkey population to range between 400-600

³ Macaque is any monkey within the *Macaca* genus.

animals in approximately 13 clans in 2003 with populations of patas monkeys estimated at about 450 individuals in 19 female clans (R. López-Ortiz, DNER, pers. comm. 2007). In 2006, the patas population in southwestern Puerto Rico was estimated at 550 to 600 individuals in 9-11 groups (Massanet and Chism 2007).

The distribution of both species is described in the following DNER communication (R. López-Ortiz, DNER, pers. comm. 2004):

“The population core of both species appeared to be from CABO ROJO and LAJAS They appeared to be mostly restrained to the south of the PR-2 highway from MAYAGUEZ to YAUCO but apparently solitary males have been reported, by civilians, crossing northward the highway in SABANA GRANDE and YAUCO. Most patas reports are from CABO ROJO, LAJAS and GUANICA while rhesus appears to be more common in limestone haystack hills of the southern (in relation to the PR-2 highway) section of San Germán with few reports originated from the northern section of SAN GERMAN to MARICAO. Both species apparently use intermittent (mostly dry) creeks as corridors for their upland (northward) displacement and coastal mangroves and agricultural pastures for eastward and westward displacements.”

Currently, monkey troops occupy an approximately 800 km² area in southwestern Puerto Rico (R. López-Ortiz, DNER, pers. comm. 2007).

Further, Caribbean populations of primates have no natural predators (González-Martínez 1995). Historically, few issues have emerged from the invasive monkeys in southwest Puerto Rico, other than crop raiding. However, during the last ten years monkey numbers have increased, resulting in more frequent confrontations with humans. Human encounters have ranged from stopping vehicular traffic to raiding backyard fruit trees. In India, where rhesus monkeys are native, monkeys are often commensal with humans but aggressive behavior has led to human injuries and fatalities. Recently, an Indian official died after falling from a balcony while being attacked by rhesus macaques (The Times of India 2007). Fortunately, the rhesus monkeys are currently shy and elusive and have not formed the type of commensal relationships with humans in Puerto Rico as they have with humans in India. Monkeys can cause extensive damage and contribute to the decline of other wildlife species. Monkeys such as the vervet monkeys in Barbados are a significant agriculture pest (Baulu et al. 1987, Denham 1987) and in St. Kitts the vervet is implicated with contributing to the extinction of the St. Kitts Bullfinch (*Loxigilla portoricensis grandis*) (Bond 1985). In Puerto Rico, the patas and rhesus monkeys have become an agriculture pest with direct annual damages estimated at nearly \$300,000 and over a \$1 million in indirect costs (R. Engeman, National Wildlife Research Center (NWRC), unpublished data).

1.3.1 Need for Damage Management to Protect Human Health & Safety

The potential for disease transmission between humans and non-human primates has increased recently in Puerto Rico as populations of invasive monkeys increase and expand. Most primate disease exposures are to laboratory researchers and rhesus pet owners (Holmes et al. 1990, Jensen et al. 2004). However, as invasive monkey populations expand in Puerto Rico, more people are encountering monkeys which leads to an increase in the possibility of disease transmission. The amount of crop damage occurring as monkeys expand has led to an increase in the employment of damage management methods by local agricultural producers to reduce or alleviate monkey damage to crops which can increase the chance of disease transmission. There are also reports of an increase in the illegal trapping of monkeys for sale as exotic pets which could also increase the possibility of exposure (Jensen et al. 2004). Trapping and confinement can increase stress in monkeys leading to the shedding of reactivated latent viruses (Jensen et al. 2004). During an accident involving an automobile and an adult male rhesus monkey in Puerto Rico, 25 emergency personnel were exposed to blood and other bodily fluids of the adult monkey. The adult monkey later tested positive for

antibodies to B-virus (*Cercopithecine herpesvirus*) (Jensen et al. 2004). B-virus is an alphaherpesvirus enzootic in the genus *Macaca*, which includes the rhesus monkey. B-virus exhibits mild effects in macaque hosts but is nearly 80% fatal in humans when contracted (Huff and Barry 2003, Jensen et al. 2004). The exposed emergency personnel in Puerto Rico were placed on antiviral medication and monitored for indication of possible contraction of the B-virus. After further investigation, no emergency personnel contracted B-virus. However, during follow-up interviews, all emergency personnel indicated they were unaware of the disease risks associated with monkeys, in particular rhesus monkeys (Jensen et al. 2004). The primary mode of transmission between infected monkeys and humans are bites and scratches (Jensen et al. 2004).

Most risk assessments and documented transmissions have occurred at research facilities and few studies have been conducted to assess risks associated with wild populations of rhesus monkeys (Engel et al. 2002). B-virus, like other herpesviruses, is characterized by latency periods where the virus lies dormant in the trigeminal and lumbosacral ganglia (Jensen et al. 2004). Stressing of the animal can lead to a shedding of the virus which can occur during illness, transport, breeding, confinement, and from other environmental stressors. Kapsalis (1985) and Laundenslager et al. (1999) found that trapped and/or relocated monkeys can be stressed and act aggressive. Monkeys relocated to other unrelated monkey groups can cause high stress and potential mortality (Kessler et al. 1985).

Of concern is the high incidence of rhesus monkeys that are free ranging in Puerto Rico that are seropositive for the B-virus. In 1967, 82% of rhesus monkeys sampled on the Islet Santiago were seropositive for the B-virus which is now considered enzootic on Islet Santiago (Kessler and Hilliard 1990). Of those monkeys tested, 23% of the yearling and two-year-old monkeys, 84% of three- to four year-old monkeys, and 100% of the rhesus monkeys ≥ 5 years of age were seropositive for B-virus (Kessler and Hilliard 1990). Other published data also indicates a high rate of B-virus infection in adult rhesus monkeys ranging from 74% to 100% (Orcutt et al. 1976, Weigler 1992).

The National Institute for Occupational Safety and Health (NIOSH) (2001) recommends that all macaques be treated as potentially infectious. Since the 1930s, 43 human deaths have been reported from exposure to B-virus (NIOSH 2001, Engel et al. 2002). Most documented infections have occurred among laboratory researchers and pet owners. There has been one documented case (1997) of ocular exposure to B-virus while handling a macaque. The researcher died, even with treatment for B-virus exposure (NIOSH 2001).

In addition to B-virus, monkeys have been known to transmit numerous other diseases to humans (Wolfe et al. 1998). Table 1-1 lists infectious diseases that are transmissible from non-human primates to humans. Two types of viral hemorrhagic fevers, Ebola and Marburg, have been passed to laboratory researchers from infected monkeys (Center for Disease Control and Prevention (CDC) 1989, CDC 1990) and several simian immunodeficiency viruses potentially may affect humans (Peeters et al. 2002). Malaria may also be transmitted from infected monkeys to humans (Cogswell 2000). Two species of *Plasmodium* have been found in rhesus monkeys (*P. cynomolgi* and *P. inui*). Hepatitis A, Hepatitis B, and Hepatitis E may be found in the patas and rhesus monkeys, respectively. The diseases listed below have all been identified and classified by scientists (Wolfe et al. 1998); however, there is the potential for other unidentified or undiscovered diseases to exist that could potentially infect humans (Renquist and Whitney 1987, Weber et al. 1998).

Table 1-1. Routes of pathogen exchange between humans and non-human primates (adapted from Wolfe et al. 1998).

Route of exchange	Pathogen	Direction of Exchange	Evidence ^a
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Animal bite	Herpes B; Monkeypox	Non-human primate to human	E
Fecal-oral	Poliovirus	Human to non-human primate; Chimpanzee to Chimpanzee	E E
Hunting, food prep, eating	Ebola	Non-human primate to human	E
Nasal secretions	<i>Mycobacterium leprae</i>	Among primates	P,L
Vector-borne	Malaria Filaria	Human to non-human primate; Non-human primate to human	L,E L,E
Water-mediated	Dracunculiasis; Schistosomiasis	Human to non-human primate; Non-human primate to human	L E
Xenotransplantation	SV40	Non-human primate to human	E ^b
^a L = laboratory; E = epidemiologic; P = evidence that parasites live naturally in multiple primate hosts.			
^b The only current evidence for xenotransplantation includes SV40 spread through vaccine production.			

Rabies is ubiquitous in Puerto Rico and could be a serious health risk if monkeys begin invading urban areas. The Indian mongoose (*Herpestus auropunctatus*) is the primary source of rabies in Puerto Rico. There have been concerns that interactions between monkeys and mongoose in Puerto Rico could lead to exposure of monkeys to the virus. If rabies becomes prevalent in the monkey population, human exposure through contact with monkeys could occur especially if monkey populations continue to increase and become commensal with humans.

Other zoonotic diseases that threaten human safety from exposure or handling of monkeys include tuberculosis, salmonella, shigella, campylobacter, giardiasis, and monkeypox (Renquist and Whitney 1987, Walter Reed Army Institute 1988, Wolfe et al. 1998).

Fortunately, historically few disease issues have emerged from the monkeys in southwest Puerto Rico; however, invasive monkey populations have grown and expanded leading to more frequent confrontations between humans and invasive monkeys. This increased exposure increases the likelihood of transmission occurring. The threat of disease transmission from non-human primates to humans remains relatively low but does not decrease or invalidate the concerns of health officials of possible exposure of humans to enzootic diseases from encounters with monkeys.

1.3.2 Need for Action to Protect Agriculture

As populations of invasive monkeys expand and grow in Puerto Rico, the amount of agricultural damage has also increased and has become economically burdensome for some agricultural producers. González-Martínez (1995) found groups of patas in southwestern Puerto Rico feeding on watermelons, squash, and sweet corn. Monkeys often feed in large social groups which can cause extensive localized damage in an area. Damage to agricultural resources occurs primarily to fruits and vegetables grown for commercial sale. Damage can occur to a wide range of fruits and vegetables including pumpkins, watermelons, cucumbers, papaya, banana, and corn (R. Engeman, NWRC, unpublished data). Though some damage to agricultural resources caused by monkeys was identified in the early 1990s (González-Martínez 1995), a concern was raised that an expanding monkey population could further threaten agricultural resources in Puerto Rico (González-Martínez 1995, González-Martínez 1998, González-Martínez 2004). More recent surveys of the monkey population in southwestern Puerto Rico indicate monkey populations have expanded (Jensen et al. 2004, Massanet and Chism 2007, R. López-Ortiz, DNER, pers. comm. 2007). The NWRC, in cooperation with the PRDA, recently conducted a survey of agricultural producers in southwestern Puerto Rico where monkeys are known to occur.

The survey was conducted by the NWRC and PRDA in 2007 sampling over 90% of the commercial agricultural producers in southwestern Puerto Rico. The survey found that 62% of those agricultural producers reported having monkeys on their properties. Of those producers reporting monkeys on their properties, 16% reported crop damage caused by monkeys. Pumpkins and watermelons were the two crops with the highest reported damage from monkeys. Since 2002, agricultural producers have reported nearly \$1.9 million in actual economic losses to crops caused by monkeys (R. Engeman, NWRC, unpublished data).

Of those agricultural producers reporting damage caused by monkeys in southwestern Puerto Rico, 57% had switched, either entirely or partially, to crops that are less susceptible to monkey damage, such as pasture or the harvest of hay. Of those switching to alternative crops less susceptible to monkey damage, 75% had completely converted agricultural operations to alternative crops. Most producers indicated crops were switched to alternative crops prior to 2004. The conversion of highly susceptible crops to less susceptible alternatives is likely the reason the reported amount of crop damage decreased from over \$600,000 in 2002 to about \$300,000 in 2006. However, the economic loss from switching to less susceptible crops increased when considering the economic value lost of not planting susceptible crops. The economic loss associated with switching to alternative crops increased from over \$500,000 in 2002 to over \$1.3 million in 2006 (R. Engeman, NWRC, unpublished data). Based on preliminary analyses of the survey data, the total net loss to agricultural producers in Puerto Rico from direct damage caused by monkeys and the economic loss associated with switching to crops with a lower economic return increased from \$1.1 million in 2002 to \$1.4 million in 2006 despite the actual damage to agricultural crops caused by monkeys decreased during the same time period (R. Engeman, NWRC, unpublished data).

1.3.3 Need for Action to Protect Natural Resources, including T&E Species

Invasive monkeys released from captivity and escaped from experimental populations in Puerto Rico have the potential to negatively impact native flora and fauna if populations are allowed to grow and expand (Evans 1989, González-Martínez 1995, González-Martínez 1996, González-Martínez 2004). Of concern are the potential negative impacts that an invasive species, such as the monkeys found in Puerto Rico, could have on native flora and fauna through exploitation and predation. Monkeys are considered omnivorous with diets consisting of primarily vegetative matter but will feed on small mammals and birds when opportunities arise. The opportunistic feeding habits of invasive monkeys in Puerto Rico have raised concerns of predation and excessive feeding on native fauna and flora, especially predation on several species considered threatened and endangered in Puerto Rico or species showing significant declining populations. As the monkey population increases, expansion into naive areas of Puerto Rico is likely where impacts on threatened and endangered species could occur.

In 1966, the NIH released a group of 57 rhesus monkeys on Desecheo Island off the west coast of Puerto Rico to study primate ecology and behavior. By 1969, concerns were raised that the monkeys might be having impacts on nesting seabirds on the island. Evans (1989) theorized the invasive monkeys had become opportunistic nest predators on the island. By 1970, colonies of nesting seabirds had abandoned Desecheo Island likely due to nest predation by the invasive monkeys (Evans 1989). NIH ended its research on the island in 1970 and allowed the Caribbean Primate Research Center to continue ecological studies of the monkeys. Research on the introduced rhesus monkeys on the island was terminated at the end of 1971. Raffaele (1989) indicated that the Desecheo breeding population of red-footed boobies (*Sula sula*) had been adversely impacted from predation by invasive monkeys. A few red-footed booby breeding pairs have started nesting on other islands uninhabited by monkeys or other predators. Evans (1989) indicated that introduced monkey populations on

Desecheo Island may have significantly impacted red-footed booby, brown booby (*Sula leucogaster*), noddy tern (*Anous stolidus*), and bridled tern (*Sternus anaethetus*) nesting colonies resulting in abandonment of the island by those bird species.

There is also anecdotal evidence that invasive monkeys in Puerto Rico have depredated nests of the endangered yellow-shouldered blackbird (*Agelaius xanthomus*) (R. López-Ortiz, DNER, pers. comm. 2004). The yellow-shouldered blackbird is an endangered species mainly because of brood parasitism by shiny cowbirds (*Molothrus bonariensis*) and predation by introduced species (Post and Wiley 1976, Wiley et al. 1991, R. López-Ortiz, DNER, pers. comm. 2002). Only 770-1,200 yellow-shouldered blackbirds were thought to exist on the island from 1982-1986. DNER biologists believe that in less than a week in June 2002, monkeys raided and destroyed the contents of 30 yellow-shouldered blackbird nests (built in artificial nest structures) being monitored by researchers in the Boquerón Commonwealth Forest (R. López-Ortiz, DNER, pers. comm. 2002). Though several factors have contributed to the endangered status of yellow-shouldered blackbirds in Puerto Rico, predation events can pose substantial risks when coupled with other deleterious events (Schoener et al. 2001).

Macaques have also been implicated with predating eggs and fledglings of birds on the Island of Mauritius in the southwestern Indian Ocean. Several researchers have implicated the long-tailed macaque (*Macaca fascicularis*) with the decline and/or extinction of some endemic bird species (Sussman and Tattersall 1986). Sussman and Tattersall (1986) state that the monkeys may feed on eggs and fledgling birds but there is no evidence that they are a real threat to plant or animal life.

During analyses of the stomach contents of rhesus monkeys captured on Desecheo Island, Evans (1989) found evidence of monkeys preying on reptiles. A portion of a Puerto Rican crested anole (*Anolis cristatellus*) was found in the cheek pouch of a female rhesus monkey collected by Evans (1989) from Desecheo Island. Morrison and Menzel (1972) indicated that during observations of rhesus monkeys, monkeys appeared to have no interest in reptiles despite the high abundance of reptiles on Desecheo Island. Evans (1989) speculated reptiles may provide needed nutritional supplements during infant rearing since the female collected with anole remains was lactating and carrying an infant. Evans (1989) was unable to verify the findings of Morrison and Menzel (1972) that rhesus monkeys were disinterested in reptiles on the islands based on the limited observation conducted during the removal of rhesus monkeys. However, based on the limited stomach content analyses conducted as part of a monkey removal program on Desecheo Island, Evans (1989) theorized impacts of monkey predation on island reptiles was insignificant. González-Martínez (1995) also found evidence of patas monkeys feeding on the Puerto Rican crested anole and the Puerto Rican ground lizard (*Ameiva exsul*) in southwestern Puerto Rico. Predation events, when occurring to threatened and endangered species, can compound other deleterious events occurring, especially when populations are small and confined to islands. Several species of reptiles are endemic to Puerto Rico and surrounding islands, including several reptiles listed as threatened and endangered (see Appendix C).

Morrison and Menzel (1972) found rhesus monkeys on Desecheo Island were also feeding on cactus which was also observed by Evans (1989). Since no natural sources of fresh water exist on the island, Evans (1989) theorized monkeys obtain water from vegetative sources, including the pulp of cactus. Rhesus monkeys were observed feeding heavily on cactus pulp after heavy rains, especially during the dry season which led Evans (1989) to speculate that cactus was an important source of water for rhesus monkeys on the island. The Higo Chumbo (*Harrisia portoricensis*) cactus plant is a federally threatened species in Puerto Rico, including a population on Desecheo Island. Though no documented events of feeding on Higo Chumbo has occurred, observations by Morrison and Menzel

(1972) and Evans (1989) of rhesus monkeys using cactus plants as a food and water source provides an indication that feeding on Higo Chumbo may be occurring on the island. During observation of monkeys in southwestern Puerto Rico in the early 1990s, González-Martínez (1995) found that 65% of the diet of monkeys consisted of native plant species or components of native plant species.

Also of concern is the critically endangered Puerto Rican parrot (*Amazona vittata*) which was once found throughout Puerto Rico and outlying islands. Today, the wild population of Puerto Rican parrots is confined to the Caribbean National Forest in eastern Puerto Rico with a wild population estimated at 30 to 40 individuals making the parrot one of the rarest birds in the world (USFWS 1999, Engeman et al. 2006). Predation has been implicated as one of the limiting factors currently threatening the survival of parrots in Puerto Rico (Snyder et al. 1987, Lindsey et al. 1994, USFWS 1999, Engeman et al. 2006). Given the expanding population of monkeys in Puerto Rico, concern arises from the potential for monkeys to expand into areas where parrots are nesting which could lead to nest predation since monkeys are known predators of bird nests (Sussman and Tattersall 1986, Evans 1989, R. López-Ortiz, DNER, pers. comm. 2002, López-Ortiz, DNER, pers. comm. 2004). With a population size estimated at 30 to 40 individuals, any predation event threatens the survival of the species. Predation coupled with other deleterious events could have catastrophic affects on wild parrot populations (Engeman et al. 2006).

The opportunistic feeding habits of monkeys has raised concern that exploitation of native flora and fauna resources could be detrimental to the survival of those native species, especially when populations of those species are relatively small.

1.3.4 Need for Action to Protect Property

Currently, damage to property from invasive monkeys in Puerto Rico is not well documented and is likely limited to isolated incidents where monkeys cause damage while searching for food. Rhesus monkeys have not formed the commensal relationship with humans that are commonly found where rhesus monkeys are native, such as India (Southwick and Siddiqi 1994). However, as the rhesus monkey population in Puerto Rico continues to increase, the concern arises that monkeys will form a more commensal relationship with humans as food resources become more limited due to an expanding population. Property damage often arises as commensal monkeys enter residential buildings and other structures in search of food. As populations expand into areas near residential areas, concerns arise from the potential for people to begin feeding monkeys which conditions the monkeys to associate people with food sources. This association can often lead to attacks on people and damage to property as monkeys search for food in residential areas.

Currently, property damage caused by monkeys in Puerto Rico is likely minor. However, as populations of monkeys increase and expand into areas with higher human populations, monkeys could become commensal with humans (González-Martínez 1995, González-Martínez 1998, González-Martínez 2004). If commensalism occurs, the likelihood of property damage is also likely to increase.

1.4 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

1.4.1 WS' Programmatic FEIS

WS prepared a FEIS that addresses the potential impacts of WS' operational activities on the quality of the human environment through scoping and analyses of issues (USDA 1997). Information in USDA (1997) has been incorporated by reference into this EA.

1.5 DECISION TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, responsible for the scope, content, and decisions made. The DNER, PRDA, and the USFWS are cooperating agencies in the development of the EA and provided input throughout the EA preparation process to ensure an interdisciplinary approach according to NEPA and agency mandates, policies, and regulations. AC has also reviewed the pre-decisional EA for AWA compliance and to ensure safe handling and appropriate methods are employed.

Based on the scope of this EA, the decisions to be made are: 1) whether WS, the DNER, the PRDA, and the USFWS should attempt to reduce invasive patas and rhesus monkey threats and damage in Puerto Rico, 2) should damage to agricultural resources, property, and natural resources and threats to human safety be allowed to continue, and 3) would the proposed action result in adverse impacts to the environment requiring the preparation of an Environmental Impact Statement (EIS).

1.6 SCOPE OF THIS EA

1.6.1 Actions Analyzed

This EA evaluates the actions of conducting alternative strategies by WS, the DNER, the PRDA, and the USFWS to managing damage and threats associated with invasive patas and rhesus monkeys on the mainland of the Commonwealth of Puerto Rico and associated satellite islands. Actions could occur by individual cooperating agencies or as part of collaborative efforts between cooperating agencies. The alternatives were developed to address the identified issues associated with providing damage management activities that provide assistance to those experiencing damage or threats from invasive monkeys in Puerto Rico.

The proposed action would allow WS and cooperating agencies to employ methods in an integrated approach to address damage or prevent damage from occurring to agricultural resources, natural resources, and property and to reduce threats to human safety caused by monkeys. The methods available for use under the alternatives evaluated are provided in Appendix D. The alternatives and Appendix D also discusses how methods would be employed to manage damage and threats associated with monkeys in Puerto Rico. Therefore, the actions evaluated in this EA are the use of those methods available under the alternatives and the employment of those methods by WS, the DNER, the PRDA, and the USFWS to manage or prevent damage and threats associated with monkeys from occurring.

1.6.2 Period for which this EA is Valid

This EA would remain valid until WS and cooperating agencies determine that new needs for action, changed conditions, or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document would be supplemented pursuant to NEPA. Review of the EA would be conducted each year as part of the planning process by WS, DNER, PRDA, USFWS, and other appropriate agencies and/or entities to ensure that the EA is sufficient.

1.6.3 Site Specificity

Actions could be taken to protect human health and safety, reduce damage to agricultural resources, alleviate property damage, and protect native wildlife, including T&E species, in the Commonwealth of Puerto Rico and its satellite islands (including, but not limited to Desecheo, Islet Santiago, Mona, Vieques, and Culebra). As mentioned previously, WS and cooperating agencies will only conduct damage management activities when requested by the appropriate property owner or manager. Therefore, mention of specific facilities or islets does not indicate damage management activities will occur on the islets or at the facilities but only that damage management activities could occur if requested by the appropriate entity. Activities could also occur on property owned or managed by the DNER or the USFWS. Within the known range of monkeys in southwest Puerto Rico and the associated islands, activities could be conducted on the Cabo Rojo National Wildlife Refuge, Laguna Caragena National Wildlife Refuge, and Desecheo Island National Wildlife Refuge. Additional NEPA documentation would be required to conduct wildlife damage management that is outside the scope of this EA should the need arise.

In the early 1990s, González-Martínez (1995) found monkeys could be found within a 125 km² area of southwestern Puerto Rico with the patas monkey population estimated at 120 individuals and the rhesus monkey population estimated at approximately 130 individuals. More recent surveys indicate the patas population have increased to 550 to 600 individuals (Massanet and Chism 2007) with the range of monkeys expanding to an area estimated to encompass approximately 800 km² in southwestern Puerto Rico (R. López-Ortiz, DNER, pers. comm. 2007).

This EA analyzes potential effects of an invasive patas and rhesus monkey damage management program that could occur on private or public property under MOUs, cooperative service agreements, or other comparable documents, and in cooperation with the appropriate land management agencies. It also addresses the effects of management actions in areas where additional agreements for damage management may be signed in the future. Thus, this EA anticipates this potential for additional requests and analyzes the impacts of such efforts as part of the program.

Planning for the management of monkey damage must be viewed as being conceptually similar to other agency actions whose missions are to stop or prevent adverse consequences from anticipated and unanticipated future events for which the actual sites and locations are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire departments, police departments, and emergency clean-up organizations. Although some of the sites where invasive monkey damage will occur can be predicted, all specific locations or times where such damage will occur in any given year cannot be predicted. The EA emphasizes important issues as they relate to specific areas whenever possible. However, the issues that pertain to the various types of monkey damage and resulting management are the same, for the most part, wherever they occur, and are treated as such.

WS and cooperating agencies will use a thought process derived from Slate et al. (1992) for each site-specific procedure for determining methods and strategies to be used or recommended for individual actions conducted in the Commonwealth of Puerto Rico. Decisions made using this thought process will be in accordance with any minimization measures and standard operating procedures (SOPs) described herein and adopted or established as part of the decision.

The analyses in this EA are intended to apply to any action that may occur *in any locale* and at *any time* to reduce invasive monkey damage or threats within the Commonwealth. In this way, the EA meets the intent of NEPA with regard to site-specific analysis and that this is the only practical way to

comply with NEPA and still be able to address damage and threats associated with monkeys in Puerto Rico.

1.6.4 Summary of Public Involvement

Issues related to the invasive monkey damage management program were initially developed by an interagency team comprised of personnel from WS, DNER, PRDA, USFWS, and AC. Issues were defined and preliminary alternatives were identified through the interagency team. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS NEPA implementing regulations, this document will be noticed to the public through legal notices published in local media, through direct mailings to parties that have requested to be notified, or have been identified to have an interest in the reduction of threats and damage caused by invasive patas and rhesus monkeys in Puerto Rico, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml.

WS and cooperating agencies will provide for a 30-day comment period for the public and interested parties to provide new issues, concerns, and/or alternatives. Through the public involvement process, WS along with the cooperating agencies will clearly communicate to the public and interested parties the analyses of potential environmental impacts on the quality of the human environment. New issues or alternatives raised after publication of public notices will be fully considered to determine whether the EA should be revisited and, if appropriate, revised prior to issuance of a final decision. New issues or alternatives identified from the public involvement process will be fully considered prior to reaching a decision on this EA.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

2.1 INTRODUCTION

Chapter 2 contains a discussion of the affected environment and issues, including the issues that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences) and those issues that will not be considered in detail with rationale.

Issues are concerns of the public and/or professional community raised regarding potential environmental problems that might occur from a proposed action. Such issues must be considered in the NEPA decision process. Issues relating to the reduction of wildlife damage were raised during the scoping process for WS' programmatic FEIS (USDA 1997) and were considered in the preparation of this EA. Issues related to managing damage associated with monkeys in Puerto Rico were developed by WS, the PRDA, the DNER, and the USFWS, in consultation with AC.

2.2 AFFECTED ENVIRONMENT

During ecology and distribution studies of the invasive monkey population on the mainland of Puerto Rico, González-Martínez (1995) found rhesus and patas monkey populations occupying an area in southwestern Puerto Rico encompassing 125 km². González-Martínez (1995) observed four distinct groups of patas monkeys and several all-male groups estimated at 120 individuals in the Sierra Bermeja range of southwestern Puerto Rico. Rhesus monkeys were also observed in the Sierra Bermeja area of southwest Puerto Rico by González-Martínez (1995) consisting of two groups. A group of rhesus monkeys were also observed in the Coutuí sector of San Germán which is 10 km north of the Sierra Bermeja range in southwest Puerto Rico (González-Martínez 1995). The rhesus population was estimated to range from 105 to 130 individuals between the two locations (González-Martínez 1995).

The Sierra Bermeja ranges are a chain of parallel hills running east and west across Puerto Rico and are part of the La Cordillera Central mountain range that divides Puerto Rico from west to east. Vegetation types of the Sierra Bermeja are fully described by González-Martínez (1995) who described the major land use practices in the area as cattle grazing and hay production. Patas monkeys in the Sierra Bermeja hill range preferred habitat areas consisting of semi-deciduous woodlands, mesquite woodlands, and areas with secondary scrub while rhesus preferred semi-deciduous woodlands and *Clusea* thickets with each species having their own preferred habitat with little overlapping of preferred vegetation type occurring (González-Martínez 1995).

Recent surveys of patas and rhesus monkeys in southwestern Puerto Rico indicate their populations are increasing (Jensen et al. 2004, Massanet and Chism 2007, R. López-Ortiz, DNER, pers. comm. 2007) compared to populations estimated in the early 1990s by González-Martínez (1995). Massanet and Chism (2007) indicated the patas monkey population in southwest Puerto Rico is increasing rapidly with the population currently estimated at 550 to 600 individuals compared to the 120 individuals estimated by González-Martínez (1995) in the early 1990s. The current range and distribution of rhesus and patas monkeys in Puerto Rico since their populations have increased is not as well defined in southwest Puerto Rico though the core area of habitation is still likely the area defined by González-Martínez (1995). Based on previous requests for assistance and observations reported to the DNER and the PRDA, range expansion has likely occurred as the populations have increased. Currently, the range of monkey troops is approximately 800 km² in southwestern Puerto Rico (R. López-Ortiz, DNER, pers. comm. 2007). Based on available habitats and the preferred habitats exhibited by patas and rhesus monkeys in southwest Puerto Rico, González-Martínez (1995) predicted that dispersion by patas monkeys would likely occur in an easterly direction while the rhesus monkey would likely expand further northward into the La

Cordillera Central area of Puerto Rico. Massanet (2007) indicated preliminary data analysis of habitat use by patas monkeys in southwest Puerto Rico conducted in 2006 indicated that patas may be utilizing areas of urban development which was not reported by González-Martínez (1995).

The northern range of the monkeys in Puerto Rico has been described as the subtropical moist mountainous area of the La Cordillera Central mountain ranges in southwestern Puerto Rico with an elevation of less than 700 meters. This area is characterized by jagged rock outcroppings, karst topography, and dense forest (R. López-Ortiz, DNER, pers. comm. 2007). Agricultural production consists of primarily avocado, mango, plantain, banana, breadfruit, oranges, and coffee with abundant and permanent water sources (R. López-Ortiz, DNER, pers. comm. 2007). The southern portion of the known monkey range consists of dry subtropical areas of the coastal plain bordered along the north by the Sierra Bermeja range. The coastal plain area is used primarily for hay production and cattle grazing (R. López-Ortiz, DNER, pers. comm. 2007). Agricultural production in the coastal area included watermelon and pumpkin until crop raiding by monkeys caused a shift to less vulnerable production (hay production and cattle grazing). Monkeys feed primarily on seasonal fruits (e.g., tamarind, Spanish lime, and mango) along the southern range but may also feed on horse and poultry feed to provide additional supplements. Monkeys obtain water primarily from artificial sources, such as cattle ponds and tanks (R. López-Ortiz, DNER, pers. comm. 2007).

The DNER currently estimates there are fewer than ten small monkey troops along the periphery of the known northern and eastern range consisting normally of less than five individuals. In the southern range, the DNER estimates there are approximately five large groups of patas monkeys totaling approximately 600 individuals with a mean size of approximately 50 individuals with some groups approaching 100 individuals (R. López-Ortiz, DNER, pers. comm. 2007). Less is known about the rhesus monkey population but are believed to be restricted to areas of the Sierra Bermeja mountain range and along the eastern edge of the known range of the monkeys in southwest Puerto Rico (R. López-Ortiz, DNER, pers. comm. 2007).

Primary activities to manage invasive monkeys in Puerto Rico are likely to occur in the core area in southwest Puerto Rico described by González-Martínez (1995) and those areas described by the DNER (R. López-Ortiz, DNER, pers. comm. 2007) where patas and rhesus monkeys are well established. However, activities could occur in other areas of Puerto Rico where monkeys are associated with damage or the threat of damage, including threats to human safety. Monkeys are considered an invasive species in Puerto Rico that can have negative impacts on resources where they occur (see Appendix B). Therefore, activities to prevent or reduce damage associated with monkeys could occur outside the core area when a request for assistance is received.

Activities could be conducted in urban and rural areas where invasive patas and rhesus monkeys are causing or may cause damage and are of concern to landowners/managers, city governments, and/or resource managers. Management areas may include U.S. government land, including National Wildlife Refuges owned or managed by the USFWS in Puerto Rico, property owned or managed by the Commonwealth, and city, private, or other lands, where assistance has been requested by a landowner or manager to protect human health and safety, agriculture, alleviate nuisance issues, and reduce impacts to wildlife species from invasive patas and rhesus monkeys. Management areas could also include property in or adjacent to identified sites where invasive patas and rhesus monkeys pose a threat to human health and safety. Invasive monkey damage management would be conducted when requested by a landowner or manager and only on properties where a MOU, cooperative service agreement, or other comparable document is in place.

2.3 ISSUES ADDRESSED IN THE ANALYSIS OF ALTERNATIVES

Issues relevant to damage management and reducing threats to human safety caused by patas and rhesus monkeys have been identified as areas of concern through an interagency team (see section 1.5). Issues identified as relevant to the broader topic of wildlife damage management were identified through the scoping process of WS' programmatic FEIS (USDA 1997). The issues, as related to the possible implementation of the alternatives, including the proposed action, are discussed in detail in Chapter 4. The issues analyzed in detail in the EA are the following:

2.3.1 Issue 1 - Effects on Invasive Monkey Populations in Puerto Rico

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on the population of target species. Methods used to resolve damage or threats to human safety can involve altering the behavior of target species and may require the use of lethal methods when appropriate. Under the proposed action, WS and cooperating agencies would incorporate non-lethal and lethal methods described in Appendix D in an integrated approach in which all or a combination of methods may be employed to resolve a request for assistance. WS and cooperating agencies would recommend both non-lethal and lethal methods, as governed by Commonwealth and local laws and regulations.

Non-lethal methods can disperse or otherwise make an area unattractive to target species causing damage reducing the presence of those species at the site and potentially the immediate area around the site where non-lethal methods are employed. Lethal methods would be employed to remove an individual or those individuals responsible for causing damage or threats to human safety. The use of lethal methods would therefore result in local population reductions in the area where damage or threats were occurring. The number of target species removed from the population using lethal methods under this alternative would be dependent on the number of requests for assistance received, the number of individuals involved with the associated damage or threat, and the efficacy of methods employed.

Patas and rhesus monkeys are considered a non-native, invasive species in Puerto Rico that are causing damage to several resources. Wildlife species, including non-native, invasive species are protected in the Commonwealth of Puerto Rico under The New Wildlife Act of Puerto Rico (Law #241). The New Wildlife Act incorporates Regulation 6765 to conserve and manage wildlife, exotic species, and hunting. However, Regulation 6765 specifically classifies monkeys as a harmful species which allows for the control of monkeys with a valid authorization from the Commonwealth of Puerto Rico. For invasive patas and rhesus monkey damage management in Puerto Rico, the DNER has the authority and will to manage invasive monkeys, and can authorize the taking of invasive monkeys for damage management purposes (see Appendix B). The PRDA, under Regulation 7399, has also declared patas and rhesus monkeys as harmful to agricultural resources and pose a threat to human safety in Puerto Rico. Regulation 7399 further restricts the introduction, importation, possession, acquisition, sale, and/or the transfer of patas and rhesus monkeys in Puerto Rico. The effects on the invasive monkey population in Puerto Rico from implementation of the identified alternatives, including the proposed action, are analyzed in Chapter 4.

2.3.2 Issue 2 - Effects on Non-target Species' Populations, Including T&E Species

The issue of non-target species effects, including effects on T&E species arises from the use of non-lethal and lethal methods identified in the alternatives. The use of non-lethal and lethal methods has the potential to inadvertently capture or kill non-target wildlife. To reduce the risks of adverse affects

to non-target wildlife, WS and cooperating agencies would select damage management methods that are as target-selective as possible or apply such methods in ways to reduce the likelihood of capturing non-target species. Before initiating management activities, WS and cooperating agencies would select locations which are extensively used by the target species and use baits or lures which are preferred by patas or rhesus monkeys. WS and cooperating agencies will also use minimization measures and SOPs designed to reduce the effects on non-target species' populations. Minimization measures and SOPs are further discussed in Chapter 3. Methods available for use under the alternatives are described in Appendix D.

The ESA states that all federal agencies “...shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act” [Sec. 7(a)(1)]. WS conducts Section 7 consultations with the USFWS to ensure compliance with the ESA and to ensure that “any action authorized, funded or carried out by such an agency...is not likely to jeopardize the continued existence of any endangered or threatened species...Each agency shall use the best scientific and commercial data available” [Sec. 7(a)(2)].

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. WS has consulted with the USFWS on programmatic activities under Section 7 of the ESA concerning potential impacts of methods available for use by WS on T&E species. The USFWS issued a Biological Opinion (BO) on WS' programmatic activities in 1992 (USDA 1997). As part of the scoping process and to facilitate interagency cooperation, WS' consulted with the USFWS under Section 7 during the development of this EA.

2.3.3 Issue 3 - Effects of Management Methods⁴ on Human Health and Safety

An additional issue often raised is the potential risks associated with employing methods to manage damage caused by target species. Both chemical and non-chemical methods have the potential to have adverse affects on human safety. However, when used appropriately, the risks to human safety are low. WS' methods available for use to manage damage and threats associated with monkeys in Puerto Rico have been widely used with minimal effects to the public for decades. WS also supports the development of new methods to enhance safety, humaneness, and selectivity through continuing research at the NWRC. The NWRC is the only facility in the world dedicated specifically to resolving wildlife-human conflicts.

WS' employees and employees of cooperating agencies use and recommend only those methods which are legally available, selective for target species, and effective to resolve the wildlife conflict. Still, some concerns exist regarding the safety of methods despite their legality. As a result, this EA will analyze the potential for proposed methods to pose a risk to members of the public or employees of WS and cooperating agencies.

In addition to the potential risks to the public associated with methods, risks to employees are also an issue. WS' employees and employees of cooperating agencies are potentially exposed to damage management methods as well as subject to workplace accidents. Selection of methods, as part of an integrated approach, includes consideration for public and employee safety.

2.3.3.1 Safety of Chemical Methods Employed

⁴ A complete list of chemical and non-chemical methods available for use under the identified alternatives, except the alternative with no monkey damage management (Alternative 3), can be found in Appendix D. However, listing methods neither implies that all methods will be used by WS to resolve requests for assistance nor does listing of methods imply that all methods will be used to resolve every request for assistance.

The issue of using chemical methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed. Under the alternatives identified, the use of chemical methods would be limited to the use of immobilizing and euthanizing drugs. The use of immobilizing drugs under the identified alternatives would only be administered to monkeys that have been live-captured using other methods. Immobilizing drugs used to sedate wildlife are used to temporarily handle and transport animals to lessen the stress of the animal from the experience. Drugs delivered to immobilize monkeys would occur on site with close monitoring of the animal to ensure proper care of the animal. Immobilizing drugs are fully reversible with a full recovery of sedated animals occurring. A list and description of immobilizing drugs available for use under the identified alternatives can be found in Appendix D.

The use of chemical methods is regulated by the U.S. Environmental Protection Agency (EPA) through the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), by Puerto Rico Laws and Regulations, by the U.S. Drug Enforcement Agency (DEA), by the U.S. Food and Drug Administration (FDA) and by Commonwealth laws and regulations. The use of chemical methods by cooperating agencies are further regulated by directives and guidelines of the respective agencies which are discussed in detail in Appendix B and WS' use of chemical methods is further discussed in WS' programmatic FEIS (USDA 1997). Based on a thorough Risk Assessment, APHIS concluded that when chemicals are used according to label directions, they are selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997).

2.3.3.2 Safety of Non-Chemical Methods Employed

Non-chemical methods employed to reduce damage and threats to safety caused by monkeys, if misused, could potentially be hazardous to human safety. Non-chemical methods are also discussed in detail in Appendix D.

Safety issues often arise from the misuse of firearms and the potential human hazards associated with firearms use when employed to reduce damage and threats. To help ensure safe use and awareness, WS requires all employees who use firearms to conduct official duties to attend an approved firearm safety training course and to remain certified for firearm use must attend a safety training course biannually (WS Directive 2.615). WS' employees who carry and use firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* (18 USC § 922(g)(9)), which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence. The use of firearms by other cooperating agencies to lethally remove monkeys will be restricted to those that are authorized to use firearms and who are trained according to directives, guidelines, and Commonwealth law. A thorough safety assessment based on site evaluations, coordination with cooperating and local agencies, and consultation with cooperators will be conducted before firearms are deemed appropriate to alleviate or reduce damage and threats to human safety when conducting activities in Puerto Rico. Cooperating agencies will work closely with cooperators requesting assistance to ensure all safety issues are considered before the use of firearms are deemed appropriate for use. The use of methods, including firearms, must be agreed upon with the cooperator to ensure the safe use of those methods.

The use of restraining devices has also been identified as a potential issue. Restraining devices include live-traps and foothold traps. Those traps pose minimal risks to the public or domestic pets when used appropriately. Restraining devices are typically set in situations where human

activity is minimal to ensure public safety. Restraining devices rarely cause serious injury and are triggered through direct activation of the device. Therefore, human safety concerns associated with restraining devices used to capture wildlife, including monkeys, require direct contact to cause bodily harm. Again, restraining devices are not located in high-use areas to ensure the safety of the public and pets. Signs warning of the use of wildlife damage management tools in the area may be posted for public view at access points to increase awareness that those devices are being used and to avoid the area, especially pet owners.

The cooperators requesting assistance is also made aware through a MOU, cooperative service agreement, or a similar document that those devices agreed upon could potentially be used on property owned or managed by the cooperator. An APHIS risk assessment in WS' programmatic FEIS concluded that threats to human safety from the use of devices to restrain wildlife were low (USDA 1997).

2.3.3.3 Effects of not Employing Methods to Reduce Threats to Human Safety

An issue identified is the concern for human safety from not employing methods or not employing the most effective methods to reduce the threats of zoonoses from invasive patas and rhesus monkeys in Puerto Rico. The risks to human safety from diseases associated with monkey populations in Puerto Rico were addressed in section 1.3.1. The low risk of disease transmission from monkeys does not lessen the concerns of cooperators requesting assistance to reduce threats from zoonotic diseases. Increased public awareness of zoonotic events has only heightened the concern of direct or indirect exposure to zoonoses. Not adequately addressing the threats associated with potential zoonoses could lead to an increase in incidence of injury, illness, or loss of human lives. This issue will be fully evaluated in Chapter 4 in relationship to the alternatives.

2.3.4 Issue 4 - Humaneness of Management Methods

The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important but very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate damage management for societal benefits could be compatible with animal welfare concerns, if "*...the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process.*"

According to the American Veterinary Medical Association (AVMA) (1987), suffering is described as a "*...highly unpleasant emotional response usually associated with pain and distress.*" However, suffering "*...can occur without pain...*," and "*...pain can occur without suffering...*" Because suffering carries with it the implication of a time frame, a case could be made for "*...little or no suffering where death comes immediately...*" (California Department of Fish and Game (CDFG) 1991). Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

Defining pain as a component in humaneness appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain and identifying the causes that elicit pain responses in humans would "*...probably be causes for pain in other animals...*" (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to considerable pain (CDFG 1991).

The AVMA states “...*euthanasia is the act of inducing humane death in an animal*” and “... *the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness*” (Beaver et al. 2001). Some people would prefer AVMA accepted methods of euthanasia be used when killing all animals, including wild and invasive animals. The AVMA states that “*For wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but terms such as killing, collecting, or harvesting, recognizing that a distress-free death may not be possible*” (Beaver et al. 2001).

Pain and suffering, as it relates to methods available for use to manage invasive patas and rhesus monkeys has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering, since “...*neither medical nor veterinary curricula explicitly address suffering or its relief*” (CDFG 1991). Research suggests that some methods can cause “*stress*” (USDA 1997). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness.

The decision-making process involves tradeoffs between the above aspects of pain and humaneness. Therefore, humaneness, in part, appears to be a person’s perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering. The issue of humaneness will be further discussed as it relates to the methods available for use under the alternatives in Chapter 4. Minimization and SOPs to alleviate pain and suffering are discussed in Chapter 3.

2.3.5 Issue 5 - Effects of Management on the Aesthetic Values of Targeted Species

One issue is the concern that the proposed action or the alternatives would result in the loss of aesthetic benefits to the public, resource owners, or neighboring residents. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature, dependent on what an observer regards as beautiful.

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American and international public share a similar bond with animals and/or wildlife in general and in modern societies a large percentage of households have indoor or outdoor pets. However, some people may consider individual wild animals and birds as “pets” or exhibit affection toward these animals, especially people who enjoy viewing wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

Wildlife populations provide a wide range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive uses, indirect benefits derived from vicarious wildlife related experiences, and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (Bishop 1987). Direct benefits are derived from a personal relationship with animals and may take the form of direct consumptive use (using parts of or the entire animal) or non-consumptive use (viewing the animal in nature or in a zoo, photographing) (Decker and Goff 1987).

Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

Public attitudes toward wildlife vary considerably. Some people believe that all wildlife should be captured and relocated to another area to alleviate damage or threats to protected resources. Some people directly affected by the problems caused by wildlife strongly support removal. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Some people totally opposed to wildlife damage management want agencies to teach tolerance for damage and threats caused by wildlife, and that wildlife should never be killed. Some of the people who oppose removal of wildlife do so because of human-affectionate bonds with individual wildlife. These human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

The effects of humaneness of methods from implementation of the identified alternatives, including the proposed action, are analyzed in Chapter 4.

2.4 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

2.4.1 Appropriateness of Preparing an EA for Such a Large Area

Lead agencies have the discretion to determine the geographic scope of their NEPA analyses (Kleppe v Sierra Club, 427 U.S. 390, 414 (1976), CEQ 1508.25). Ordinarily, according to APHIS procedures implementing the NEPA, WS' individual wildlife damage management actions may be categorically excluded (7 CFR 372.5(c)). The intent in developing this EA is to determine if the proposed action would potentially have significant individual and/or cumulative impacts on the quality of the human environment that would warrant the preparation of an EIS or a finding of no significant impact. This EA addresses impacts for managing damage and threats to human safety caused by invasive patas and rhesus monkeys in the Commonwealth of Puerto Rico and associated islands to analyze individual and cumulative impacts and to provide thorough analyses.

In terms of considering cumulative effects, one EA analyzing impacts for the entire Commonwealth will provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If a determination is made through this EA that the proposed action would have a significant impact on the quality of the human environment, then an EIS would be prepared.

2.4.2 Legal Constraints on Implementation of Management Actions

Cooperating agencies are required to follow and adhere to all U.S., Commonwealth, and local laws and regulations. The methods proposed to reduce damage and threats to human safety caused by invasive patas and rhesus monkeys in Puerto Rico are permitted by federal, Commonwealth, and local laws and the appropriate exemptions/permits will be obtained. Relevant laws and regulations as related to monkey damage management activities conducted by cooperating agencies to manage damage caused by invasive monkeys in Puerto Rico are discussed in Appendix B.

2.4.3 Cost Effectiveness of Management Methods

CEQ does not require a formal, monetized cost benefit analysis to comply with NEPA. Consideration of this issue is not essential to making a reasoned choice among the alternatives being considered. However, the methods determined to be most effective to reduce damage and threats to human safety caused by patas and rhesus monkeys and that prove to be the most cost effective will receive the greatest application. As part of an integrated approach, evaluation of methods will continually occur to allow for those methods that are most effective at resolving damage or threats to be employed under similar circumstance where monkeys are causing damage or pose a threat. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs.

2.4.4 A Loss Threshold Should Be Established Before Allowing Lethal Methods

One issue identified through WS' implementation of NEPA processes is a concern that a threshold of loss should be established before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. Some damage and economic loss can be tolerated by cooperators until the damage reaches a threshold where damage becomes an economic burden. The appropriate level of allowed tolerance or threshold before employing lethal methods would differ among cooperators and damage situations. Establishing a threshold would be difficult or inappropriate to apply to human health and safety situations.

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah denied plaintiffs' motion for a preliminary injunction. In part, the court found that a forest supervisor needs only show that damage from wildlife is threatened, to establish a need for wildlife damage management (Civil No. 92-C-0052A January 20, 1993). Thus, there is judicial precedence indicating that it is not necessary to establish a criterion such as a percentage of loss of a particular resource to justify the need for wildlife damage management actions.

2.4.5 Wildlife Damage Management should not occur at Taxpayer Expense

An issue identified through the development of WS' programmatic FEIS is the concern that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based (USDA 1997). Funding for monkey damage management activities is derived from federal appropriations and through cooperative funding. Activities conducted in the Commonwealth of Puerto Rico for the management of damage and threats to human safety from patas and rhesus monkeys will be funded through cooperative agreements.

2.4.6 Effectiveness of Management Methods

The effectiveness of any damage management program could be defined in terms of losses prevented or risks potentially prevented. Effectiveness is based on the species responsible for the damage, how accurately practitioners diagnose damage, how actions are implemented to correct or mitigate risks and damages, how quickly damage is reduced or prevented, and finally the duration damage or threats are resolved after employing methods. To determine that effectiveness, WS must be able to complete management actions expeditiously to minimize harm to non-target animals and the environment, while at the same time, using methods as humanely as possible. The most effective approach to resolving any damage problem is to use an adaptive integrated approach which may call for the use of several management methods simultaneously or sequentially (USDA 1997, Courchamp et al. 2003).

The purpose behind integrated damage management is to implement management methods in the most effective manner while minimizing the potentially harmful effects on humans, target and non-

target species, and the environment⁵. Efficacy is based on the types of methods employed, the application of the method, restrictions on the use of the method(s), the skill of the personnel using the method and the guidance provided by agency directives and policies.

The goal is to reduce damage, risks, and conflicts with wildlife as requested and not to necessarily reduce/eliminate populations. Localized population reduction could be short-term and that new individuals may immigrate, be released at the site, or be born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels, however, does not mean individual management actions are unsuccessful, but that periodic management may be necessary. The return of wildlife to pre-management levels also demonstrates that limited, localized damage management methods have minimal impacts on species populations.

Based on the evaluation of the damage situation, the most effective methods will be employed individually or in combination based on the prior evaluations of methods or combinations of methods in other damage management situations. Once employed, methods will be further evaluated for effectiveness based on a continuous evaluation of activities by cooperating agencies. Therefore, the effectiveness of methods is considered as part of the decision process for each damage management request based on continual evaluation of methods and results.

2.4.7 Potential for Monkeys to Disperse to Other Areas Due to Management Activities

Dispersal to suitable habitats in southwestern Puerto Rico has already occurred naturally from expanding monkey populations in the absence of damage management activities. González-Martínez (1995) estimated that range of monkeys in southwestern Puerto Rico to be approximately 125 km² in the early 1990s while the current known distribution of patas and rhesus monkeys in Puerto Rico is an area approximately 800 km² in southwestern Puerto Rico with individuals sometimes naturally dispersing outside of this area (R. López-Ortiz, DNER, pers. comm. 2007). An issue arose from the possible use of methods to manage damage and threats that could lead to the harassment and subsequently accelerate dispersal of those monkeys from established areas. Methods involving the pursuit, shooting, and/or harassment of monkeys could lead to the abandonment of areas traditionally used by monkeys in Puerto Rico. Dispersal could also arise from the removal of dominant individuals in larger monkey troops in Puerto Rico. If monkeys are dispersed by WS or cooperators, damages and threats could arise in those areas where monkeys dispersed.

Cooperating agencies will evaluate the damage or threat situation to determine the appropriate method to adequately resolve the request for assistance that will not result in the likely dispersal of monkeys from those activities. All activities will be coordinated between WS, the DNER, the PRDA, the USFWS, and local entities to monitor monkey populations in areas where dispersal may occur. The potential for dispersal when employing methods will be considered as part of the evaluation of the damage situation and will be incorporated into the decision-making process to determine which methods to employ and recommend. The use of methods that would likely result in the harassment or dispersal of monkeys (e.g., shooting, propane cannons, pyrotechnics), would be used in those situations where damage, threats of damage, and/or threats to human safety require immediate resolution.

Individuals from monkey troops may also be radio collared to locate and monitor movements of monkeys by cooperating agencies. González-Martínez (1995) also used radio telemetry to aid in

⁵ The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns.

locating monkeys for study in southwest Puerto Rico. Radio collaring allows cooperating agencies to track movements and locations of monkeys. The tracking of monkeys in relationship to damage management activities will also provide the ability to monitor movements and potential dispersal to other areas. Monkeys often form large groups that allow one individual monkey of the group to be captured, collared, released, and allowed to return to the group. By collaring one individual, the movement and location of an entire group can be monitored. Radio telemetry will allow cooperating agencies to monitor movements of monkeys and to respond as necessary to monkeys potentially dispersing.

Coordination between cooperating agencies and local entities will ensure any dispersing monkeys are identified and addressed when they cause damage or threaten human safety. The limited use of methods that disperse monkeys should further ensure monkeys are not being displaced to other areas within Puerto Rico. The passiveness of the primary methods proposed for use should limit dispersal of monkeys.

2.4.8 Based on Previous Efforts, Proposed Monkey Removal Efforts Likely to be Unsuccessful

An additional issue raised during previous scoping efforts has identified that prior attempts by other entities to completely remove monkeys from isolated islands in Puerto Rico and efforts to completely remove green monkeys (*Chlorocebus sabaesus*) on the islands of Barbados have failed. Concern was raised that proposed activities will likewise fail to completely remove patas and rhesus monkeys from Puerto Rico. However, the objective of the proposed action is to respond to requests for assistance with the management of damage and threats associated with invasive monkeys in Puerto Rico. WS and cooperating agencies would provide technical and operational assistance only at the direct request of a cooperator, and would only target those monkeys identified as causing the associated damage or presenting a threat to human safety on property owned or operated by the requesting entity. All activities, including methods of removal will be mutually agreed upon and acceptable to cooperating agencies and the cooperator requesting assistance in a written agreement or other comparable arrangement. Therefore, the failure to completely remove monkeys from Puerto Rico would not be considered a failure under the proposed action given that the objective is to prevent and/or resolve damage and to reduce threats to human safety caused by invasive monkeys in Puerto Rico only when requested by other entities.

The exception is in those situations where monkeys are found on property owned or managed by the USFWS or by the DNER. In those situations, the goal of invasive monkey management on property owned or managed by the respective agencies is to protect native flora and fauna and to protect human safety, which could include the complete removal of monkeys from those properties to achieve that goal. Previous attempts to completely remove monkeys from the Desecheo Island National Wildlife Refuge were unsuccessful (Evans 1989). However, Evans (1989) attributed the unsuccessful attempt to completely remove invasive monkeys on Desecheo Island to an inaccurate census of the total population on the island which led to an inadequate allocation of resources and time to achieve the objective. Therefore, the goal is to protect or restore native flora and fauna and to protect human safety on those properties and not necessarily to completely remove monkeys to achieve that goal.

2.4.9 Lack of Expertise of Cooperating Agencies in Managing Damage caused by Monkeys

Another issue raised during prior scoping efforts is the perception that cooperating agencies do not have the expertise in monkey behavior and ecology to effectively manage damage caused by monkeys in Puerto Rico. The concern arises from the notion that cooperators have no prior

experience with managing damage or threats associated with monkeys in Puerto Rico with that lack of experience in monkey behavior and management methods leading to a worsening of the damages or threats associated with those monkeys. WS and cooperating agencies have prior experience with managing monkey populations on Desecheo Island and are accustomed to addressing damage or threats posed by a variety of wildlife species, including the use of the methods required to effectively resolve or reduce damage. WS' mission is to provide leadership in resolving and preventing damage to resources and to reduce threats to human safety caused by wildlife, including invasive monkeys in Puerto Rico.

Agencies will work cooperatively with personnel from several entities to identify damage and to identify the most effective use of methods to prevent damage from occurring, to reduce damage that is occurring, and to reduce threats to human safety associated with invasive monkeys in Puerto Rico. WS has extensive expertise in the use of methods and employing those methods to effectively resolve damage and threats associated with wildlife. Based on WS' expertise in the employment of wildlife damage management methods and techniques and the availability of information on monkey behavior from cooperating agencies, cooperating agencies have the required expertise to effectively and humanely manage damage and threats associated with invasive monkeys.

2.4.10 Increase in Biohazards Associated with Captured and Deceased Monkeys

A concern raised is that capturing invasive monkeys would increase threats to human safety by exposing the public to live animals which would represent a greater threat to the public than free-ranging monkeys would if no damage management activities were conducted. In addition, a concern was raised that euthanizing monkeys could increase the risk of exposure to the public through encounters with dead monkeys. People encountering live-captured monkeys or euthanized monkeys could be exposed to zoonotic diseases if an interaction occurs. As stated previously, monkeys are known vectors of several diseases communicable to humans. Any interaction between monkeys, whether dead or alive, increases the potential transmission of those diseases if transmission conditions are favorable. In addition, the capturing and confinement of monkeys may initiate the shedding of latent viruses in non-human primates that would increase the risks of exposure if interactions occurred that were favorable for transmission (Jensen et al. 2004).

However, all actions by cooperating agencies would occur in areas where human activity is minimal and appropriate warning signs would be placed in conspicuous areas warning the public of activities occurring in the area, when appropriate. All capture devices would be checked at least daily to ensure any live-captured monkeys are addressed promptly which should limit the amount of time monkeys would be restrained in capture devices. Limiting the amount of time monkeys are restrained would also correlate to a decrease in the amount of time the public could be exposed since the risk of exposure to the public would increase the longer monkeys are left confined in a restraining device. The longer a monkey is confined increases the chances of a monkey being present when a person encountered the restraining device. If the restraining device contains no monkeys, then exposure would not occur and the only safety concern would be exposure to the safety device itself which is described in section 2.3.3.

Methods to be used by cooperating agencies on property owned or managed by the cooperator or the requestor will be outlined and must be agreed upon by the requestor, except when the cooperating agency is conducting damage management activities on property they own or manage. Thus, actions would only occur on property where the property owner or manager is aware of those activities and can regulate access to the property or provide proper warning of activities occurring on the property.

All monkeys live-captured by WS would be relinquished to the DNER and/or the PRDA for determination of the fate. If requested, WS may euthanize live-captured monkeys using AVMA approved methods of euthanasia for non-human primates outside the view and presence of the public. Disposal of euthanized monkeys would occur by deep burial or incineration. Therefore, the risks of exposure to the public from euthanized monkeys would be minimal.

Based on mitigating factors described that limit the exposure of the public to live-captured and euthanized monkeys, the risks to human safety from monkeys addressed as part of damage management activities will not increase and should remain minimal.

CHAPTER 3: ALTERNATIVES

3.1 INTRODUCTION

Chapter 3 contains a discussion of the three project alternatives, which will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences). Chapter 3 also discusses alternatives considered but not analyzed in detail, with rationale. Minimization measures and SOPs for invasive monkey damage management in Puerto Rico are also discussed in Chapter 3.

Alternatives were developed for consideration through the interagency team and by using WS' Decision Model (Slate et al. 1992, USDA 1997).

3.2 DESCRIPTION OF THE ALTERNATIVES

3.2.1 Alternative 1 – Integrated Wildlife Damage Management (Proposed Action/No Action)

This alternative, the proposed action, would continue the implementation of an adaptive approach utilizing non-lethal and lethal techniques, as deemed appropriate by the interagency team, to reduce damage and threats caused by invasive patas and rhesus monkeys in Puerto Rico. A major goal of the program would be to minimize monkey related damages and to reduce threats to human safety. To meet this goal, cooperating agencies would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding is available, operational damage management. Funding could occur through federal appropriations or from cooperative funding. The adaptive approach to managing damage associated with monkeys would integrate the use of the most practical and effective methods to resolve a request for damage management as determined by site-specific evaluation to reduce damage or threats to human safety for each request (see Appendix D for a description of potential methods). City/town managers, agricultural producers, property owners, and others requesting assistance would be provided information regarding the use of appropriate non-lethal and lethal techniques.

Non-lethal methods include, but are not limited to: habitat/behavior modification, live traps, exclusionary devices, frightening devices, chemical immobilization, and chemical repellents. Lethal methods considered by WS and cooperating agencies include: live-trapping followed by euthanasia, chemical euthanasia, and shooting. Under The New Wildlife Act of Puerto Rico (Law #241), the DNER and PRDA have management authority of wildlife species in Puerto Rico and would maintain authority over all monkeys live-captured by WS, by the DNER, and by the PRDA under this alternative; the final disposition of the animal would remain the sole responsibility of the DNER and/or the PRDA which could include euthanasia or relinquishing the live-capture monkey(s) to DNER and/or PRDA authorities. Once in the possession of DNER or PRDA personnel, the care, welfare, quarantine, and all aspects of handling live-captured monkeys will be the responsibility of the DNER and/or the PRDA. The fate of monkeys live-captured by USFWS or their contractors on property they own or manage would remain the responsibility of the USFWS. All management actions would comply with other appropriate laws, orders, policies, and regulations (see Appendix B).

Appendix D contains a thorough discussion of the methods available for use in an integrated wildlife damage management approach to address requests for assistance to manage wildlife damage or reduce threats to human safety. WS' programmatic FEIS contains additional discussion on adaptive management using an integrated approach to address damage to resources and threats to human safety (USDA 1997). As part of an integrated approach WS and cooperating agencies may provide

technical assistance and direct operational assistance to those experiencing damage associated with invasive monkeys.

Technical Assistance Recommendations

Technical assistance is information, demonstrations, and recommendations on available and appropriate wildlife damage management methods and approaches. The implementation of methods and techniques to resolve or prevent damage is the responsibility of the requester. In some cases, WS and cooperating agencies may provide supplies or materials that are of limited availability for use by private entities. Technical assistance may be provided through a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems; these strategies are based on the level of risk, need, and the practicality of their application. In some instances, wildlife-related information provided to the requestor results in tolerance/acceptance of the situation. In other instances, management options are discussed and recommended.

Operational Damage Management Assistance

Operational damage management assistance includes damage management activities that are directly conducted or supervised by personnel of the cooperating agencies. Operational damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and there is a written agreement between a cooperating agency and the entity requesting assistance. The initial investigation defines the nature, history, and extent of the problem; species responsible for the damage; and methods available to resolve the problem. The professional skills of personnel from the cooperating agencies are often required to effectively resolve problems, especially if restricted use chemicals are necessary or if the problems are complex.

Educational Efforts

Education is an important element of activities because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, lectures, courses, and demonstrations are provided to producers, homeowners, municipalities, colleges and universities, and other interested groups. Cooperating agencies frequently cooperate with other entities in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that other wildlife professionals and the public are periodically updated on recent developments in damage management technology, programs, laws and regulations, and agency policies.

Research and Development

The NWRC functions as the research arm of WS by providing scientific information and development of methods for wildlife damage management that are effective and environmentally responsible. NWRC research biologists work closely with wildlife managers, researchers, and others to develop and evaluate wildlife damage management techniques. NWRC biologists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management.

WS' Decision Making Procedures

WS' personnel use a thought process for evaluating and responding to damage complaints which is depicted by the WS Decision Model (WS Directive 2.201) and described by Slate et al. (1992). WS' programmatic FEIS provides further discussion and examples of how the Decision Model is used to address damage and threats associated with wildlife (USDA 1997). WS' personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for effectively reducing damage. WS' personnel assess the problem then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a management strategy. After this strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision Model, most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions, including the DNER, PRDA, and the USFWS.

3.2.2 Alternative 2 – Technical Assistance Only

Under this alternative, technical assistance as described in 3.2.1 would be provided to those requesting information on managing damage and threats caused by patas and rhesus monkeys in Puerto Rico. Only those methods legally available for use by the appropriate individual would be recommend or loaned. The DNER and PRDA would continue to maintain authority over the take and possession of the monkeys under The New Wildlife Act of Puerto Rico (Law #241). However, cooperating agencies would not be directly involved with managing invasive monkey damage in Puerto Rico. Those experiencing damage would be provided guidance, recommendation, and demonstration of methods and techniques to resolve monkey damage. Some loaning or providing of equipment could occur under this alternative, such as providing traps or exclusionary devices.

This alternative would place the immediate burden of operational damage management work on the resource owner and other governmental agencies. The DNER and PRDA would maintain authority over monkeys in Puerto Rico and therefore, would have to permit any take of monkeys. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent monkey damage as permitted by the DNER and PRDA or those persons could take no action.

3.2.3 Alternative 3 – No Monkey Damage Management in Puerto Rico

This alternative precludes any and all activities to protect human health and safety, protect agricultural resources, alleviate damage to property, and protect native wildlife species from impacts of invasive patas and rhesus monkeys in the Commonwealth of Puerto Rico. WS and cooperating agencies would not provide operational or technical assistance to those requesting assistance. The DNER and the PRDA would not permit any monkey damage management activities to occur in Puerto Rico under this alternative. Those requesting assistance would be provided with information on cultural practices and exclusion but no demonstration, site visits, or loaning of equipment would occur under this alternative. Since damage management activities would not be permitted by Commonwealth authority, those experiencing damages or threats would be limited to dispersal, harassment, or exclusionary techniques that would not involve the taking of monkeys.

3.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

3.3.1 Trap, Sterilize, and Release (TSR)

This topic has undergone considerable debate in animal welfare and scientific communities for a number of years. The debate focuses on whether controlling feral, free-ranging, or invasive animal populations through TSR programs are effective and alleviate problems (*i.e.*, diseases, predation, agricultural damage, and human safety).

Theoretically, TSR would work if all animals of one sex or both were sterilized. However, the probability of controlling invasive species in the wild with this technique is not currently reasonable, especially with the animals being self-sufficient and not relying on humans to survive. Additionally, some individuals within a population can be trap shy. Capturing or removing trap shy individuals often requires implementing other methods.

In addition, the National Association of State Public Health Veterinarians and the AVMA oppose TSR programs based on health concerns and threats⁶ (Journal of the American Veterinary Medical Association (JAVMA) 1996). Of major concern are the potential for diseases and parasites transmission to humans either from direct contact during sterilization or the risk of exposure after the animal is released. B-virus and other communicable diseases are a serious threat when handling monkeys. Once live-captured, performing sterilization procedures during field operations on anesthetized monkeys would be difficult. Sanitary conditions are difficult to maintain when performing surgical procedures in field conditions. To perform operations under appropriate conditions, live-captured monkeys would need to be transported from the capture site to an appropriate facility which increases the threat from handling and transporting. A mobile facility could be used but would still require additional handling and transporting of the live-captured monkeys to the facility. Once the surgical procedure was completed, the monkey would have to be held to ensure recovery and transported back to the area capture occurred.

TSR programs are often not as successful as desired and needed to reduce immediate threats posed by wildlife, especially when human safety is a concern (AVMA 2003, Barrows 2004, Levy and Crawford 2004, Jessup 2004, Winter 2004). Invasive monkeys subjected to TSR would continue to cause the same problems⁷ they caused before the TSR program was initiated because of slow attrition. TSR programs can take a decade or longer to reduce target species populations (Barrows 2004, Winter 2004) especially when acute issues need rapid solutions (Levy and Crawford 2004, Stokopf and Nutter 2004). Several studies report that target species populations often remain stable or increase following TSR programs due to immigration and reproduction from other members of the groups (Castillo and Clarke 2003, Levy and Crawford 2004, Winter 2004) with little to no resolution of threats to human safety or damages (Barrows 2004, Slater 2004, Winter 2004).

Other concerns arise when considering the legality of TSR programs given the documented damage caused by target species, especially to native wildlife (Barrows 2004, Levy and Crawford 2004, Jessup 2004). Some have questioned whether TSR programs are violating the ESA because released animals may continue to kill migratory birds and/or endangered species (Barrows 2004, Levy and Crawford 2004, Jessup 2004). As a result of the continued threat to human safety created by TSR

⁶ Eighty-two percent of monkeys sampled in Cayo Santiago were seropositive for the B virus in 1967 (Kessler and Hilliard 1990).

⁷ Brickner (2003), Levy et al. (2003), Barrows (2004), and Jessup (2004) reported that sterilized cats that do not spend any time on courting and mating are left with more time to hunt than non-sterilized cats and therefore, continue to remain as potential reservoirs of animal and human disease, a social nuisance, and continue to hunt and kill protected species.

programs and the continued threat to T&E wildlife and native wildlife in general, this alternative will not be considered further.

3.3.2 Trap and Relocate Back into the Wild

This alternative would allow the live-capture of invasive patas and rhesus monkeys using walk-in traps, drop-nets, cannon nets, foothold traps, and/or other live-capture methods. Captured animals would be tranquilized and translocated to other areas where they would be released back into the wild or free living state.

Relocation of wildlife is often viewed as inhumane and biologically unsound management, especially when the wildlife species being relocated is exotic, non-native, and considered a human health and safety threat. Consequently, WS and cooperating agencies will not relocate any invasive patas and rhesus monkeys captured during direct operations back into the wild.

3.3.3 Use of Non-lethal Methods Only

Under this alternative, the interagency team would be required to implement only non-lethal methods to resolve damage caused by invasive monkeys in Puerto Rico. Given the behavior of patas and rhesus monkeys, very few non-lethal techniques have proven effective in adequately addressing damage and threats associated with monkeys to agricultural resources in Puerto Rico (J. Laborde, PRDA, pers. comm. 2007). Harassment and dispersal techniques would be limited to audio and visual cues that invoke a flight response. Non-lethal methods often have a high rate of habituation after multiple applications. To lessen habituation, non-lethal harassment and dispersal techniques require application only when monkeys are present which can lead to elevated costs from increased monitoring of vulnerable resources.

Exclusionary devices can be effective in preventing access to resources in certain circumstances. The primary exclusionary methods are fencing and netting. Exclusion is most effective when applied to small areas to protect high value resources. However, exclusionary methods are neither feasible nor effective for protecting human safety, agriculture, or native wildlife species from invasive patas and rhesus monkeys across large areas. The proposed action, using an integrated damage management approach, incorporates the use of non-lethal methods when addressing requests for assistance. In those instances where non-lethal methods would effectively resolve damage from invasive monkeys, those methods would be used or recommended under the proposed action. Since non-lethal methods would be available for use under the alternatives analyzed in detail, this alternative would not add to the analyses.

3.3.4 Use of Non-lethal Methods before Lethal Methods

This alternative would require that all non-lethal methods or techniques described in Appendix D be applied to all requests for assistance to reduce damage and threats to safety from patas and rhesus monkeys. If the use of all non-lethal methods fails to resolve the damage situation or reduce threats to human safety at each damage situation, lethal methods would be employed to resolve the request. Non-lethal methods would be applied to every request for assistance regardless of severity or intensity of the damage or threat until deemed inadequate to resolve the request. Verification of the methods used would be the responsibility of the cooperating agencies. No standard exists to determine requester diligence in applying these methods, nor are there any standards to determine how many non-lethal applications are necessary before the initiation of lethal methods. Thus, only the presence or absence of non-lethal methods can be evaluated. The proposed action described in

section 3.2.1 is similar to a non-lethal before lethal alternative because the use of non-lethal methods is considered before lethal methods (WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not add additional information to the analyses in this EA.

3.3.5 Use of Lethal Methods Only

This alternative would require the use of lethal methods only to reduce threats and damage associated with invasive patas and rhesus monkeys. All live-captured monkeys would be euthanized using appropriate methods. However, exclusionary devices can be effective in preventing damage in certain confined instances. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. In those situations where damage could be alleviated using exclusionary devices or other non-lethal methods deemed effective, those methods would be employed or recommended as determined by the decision models of the cooperating agencies. Therefore, this alternative was not considered in detail.

3.3.6 Establish a Harvest Season on Monkeys in Puerto Rico

A common alternative raised is allowing monkeys to be harvested either through a regulated harvest season or an unregulated season that allows the public to take monkeys at any time. Under a harvest season alternative, the public would be allowed to harvest monkeys for sport using allowable firearms or other methods of take. This alternative would direct WS and cooperating agencies to work with the DNER and PRDA to establish a harvest season on monkeys in Puerto Rico. WS and the USFWS have no authority to establish harvest seasons in Puerto Rico therefore, the establishment of a harvest season would be the direct result of the DNER and PRDA pursuing such a season as allowed by Puerto Rican laws and regulations.

Additional concerns are raised regarding establishing a harvest season considering the potential safety threats associated with people handling dead monkeys that could result in transmission of disease to the handler or others when the appropriate safety procedures for handling of monkeys are not followed. The risk of disease transmission would be high when dead monkeys are handled by those not trained in the appropriate safety precautions of handling monkeys. Contact with blood and other bodily fluids when handling monkeys harvested during a harvest season is highly likely. Those not properly trained or unaware of the safety threats of monkeys would risk transmission of disease to themselves and others. During an incident where a monkey was struck by a vehicle and 25 emergency personnel were exposed to bodily fluids of the injured monkey in Puerto Rico, the emergency personnel were placed in a high risk scenario due to a lack of knowledge of the potential disease risks associated with monkeys (Jensen et al. 2004). A lack of understanding of the disease risks associated with contacting body fluids of deceased monkeys could place those harvesting monkeys at a high exposure risk. Under a harvest season alternative, an educational program would have to be implemented to inform the public of the safety hazards associated with handling deceased monkeys and the appropriate personal protective equipment required for safe handling.

A harvest season would not necessarily address specific damage situations, especially when damage occurs outside the harvest season. Dispersal of monkeys could occur under a harvest season especially if harvest of a few individuals occurs and the activity is ceased with no pursuit of those individuals that may be dispersed. Harvest of wildlife is often a management approach used to stabilize or regulated increasing wildlife populations. Monkey populations could be stabilized or reduced under a harvest season but would be highly dependent on several factors, including the interest in harvesting monkeys, the effectiveness of methods employed to harvest monkeys, the

competency of those employing harvest methods in using those methods, and an overall understanding of the biology of monkeys. However, given the safety concerns associated with handling monkeys, the threat of dispersing monkeys under this alternative, and the ineffectiveness of a harvest season to prevent or reduce damage from occurring, this alternative, to establish a harvest season to manage damage caused by monkeys in Puerto Rico will not be analyzed in further detail.

3.4 MINIMIZATION AND SOPs FOR WILDLIFE DAMAGE MANAGEMENT TECHNIQUES

3.4.1 Minimization Measures

Minimization measures are any features of an action that serves to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS' program, nationwide and in Puerto Rico, uses many such minimization measures and these are discussed in detail in Chapter 5 of WS' programmatic FEIS (USDA 1997). These minimization measures will be incorporated into activities conducted by WS and cooperating agencies when addressing monkey damage and threats in Puerto Rico.

Some key minimizing measures pertinent to the proposed action and alternatives include the following:

- ◆ The WS' Decision Model and the comparable decision-making processes of cooperating agencies, which are designed to identify effective wildlife damage management strategies and their impacts, are consistently used and applied when addressing invasive monkeys in Puerto Rico.
- ◆ Non-target animals captured in traps are released unless it is determined by an employee of the cooperating agencies that the animal will not survive and/or that the animal can not be released safely.
- ◆ Conspicuous, bilingual warning signs alerting people to the presence of traps may be placed at major access points to areas where active patas and rhesus monkey management operations are occurring, when appropriate. Signs will be placed when the presence of the signs would not impact the efficacy of the management activities occurring in an area by alerting people to the presence of monkeys or the presence of equipment used for damage management purposes. The efficacy of activities could be lessened or compromised if people are alerted to the presence of activities in the area and choose to ignore the warning signs by trying to locate equipment or monkeys. Therefore, the presence of signs could lead to an increased risk of exposure to monkeys and equipment if people are alerted and choose to ignore the signs. The use of signs will be based on human activity in the area and the ability of the property owner or manager to control access to the property by the public.
- ◆ Reasonable and prudent alternatives and measures are established through consultation with the USFWS and implemented to avoid adverse impacts to T&E species.
- ◆ All personnel who use chemicals are trained and certified to use such substances or are supervised by trained or certified personnel.
- ◆ Management actions are directed toward specific species or individual animals posing a threat to human health and safety, causing agricultural damage, predated on native wildlife species,

or causing damage to property. Control actions would only be directed towards invasive patas and rhesus monkeys in Puerto Rico.

- ◆ Weather and environmental conditions permitting, all field equipment would be checked at least once each day. If daily checking is not possible, all control equipment would be removed from the site or would be made inactive.
- ◆ Trap monitoring devices will be employed when applicable that indicate when a trap has been activated. Trap monitoring device will allow personnel to prioritize trap checks and decrease the amount of time required to check traps which decreases the amount of time captured monkeys are restrained. By reducing the amount of time monkeys are restrained, pain and stress can be minimized which will reduce the distress of captured monkeys.
- ◆ Although hazards to the public from control devices and activities are low according to a formal risk assessment conducted in WS' programmatic FEIS (USDA 1997), hazards to the public and their pets are even further reduced by the fact that control activities are primarily conducted by trained wildlife damage management personnel away from areas of human activity. Management activities will be conducted primarily on remote islands and in rural agricultural areas where human activity in areas where monkeys frequent is minimal. If requests for assistance are received in urban areas where human contact with equipment or with monkeys live-captured is likely, the methods employed by cooperating agencies will be evaluated to minimize human exposure and/or will be closely monitored to ensure exposure does not occur.

3.5 ADDITIONAL MINIMIZATION MEASURES SPECIFIC TO THE ISSUES

The following is a summary of additional minimization measures that are specific to the issues listed in Chapter 2 of this document.

3.5.1 Issue 1 - Effects on Invasive Monkey Populations in Puerto Rico

- ◆ Lethal take (kill) of monkeys will be reported and monitored by WS, by the USFWS, the DNER, and the PRDA to evaluate method efficacy, humaneness, and evaluate new alternatives as they become available.

3.5.2 Issue 2 - Effects on Non-target Species' Populations, including T&E Species

- ◆ When conducting removal operations via shooting, identification of the target will occur prior to application.
- ◆ As appropriate, suppressed firearms will be used to minimize noise impacts.
- ◆ When conducting nighttime activities, potential impacts associated with spotlights would be minimized by the use of night vision equipment, infrared devices, or red filtered spotlights.
- ◆ Human presence at control sites would be kept to the minimal time needed to accomplish the management action.

- ◆ Personnel will use lures, trap placements (sets), and capture devices that are strategically placed at locations likely to capture a target animal and minimize the potential of non-target animal captures.
- ◆ As appropriate, capture devices will be equipped in such a manner to reduce the potential of capturing non-target animals, (e.g., pan tension devices).
- ◆ Any non-target animals captured in cage traps, nets, foothold traps, or any other restraining device will be released whenever it is possible and safe to do so.
- ◆ Trap monitoring devices will be employed where applicable to facilitate monitoring of the status of traps in remote locations to ensure any captured wildlife is removed promptly to minimize pain and distress.

3.5.3 Issue 3 - Effects of Management Methods on Human Health and Safety

- ◆ Damage management activities will be conducted professionally and in the safest manner possible. Most trapping will be conducted away from areas of high human activity and when determined necessary, signs will be placed to warn the public of any potential hazards. See section 3.4.1 for additional minimization measures relating to human safety.
- ◆ Invasive patas and rhesus monkey management via shooting will be conducted professionally and in the safest manner possible. Shooting will be conducted during time periods when public activity and access to the control areas are restricted (e.g., at night). Personnel involved in shooting operations will be fully trained in the proper and safe application of this method.
- ◆ All personnel involved with direct monkey damage management activities in Puerto Rico will be trained on the proper handling of monkeys and the associated threats to human safety. Training will be provided by the NWRC, by AC, or by other entities with a thorough knowledge of monkey behavior, threats, and handling. The NWRC is currently drafting guidelines for the safe handling of monkeys for WS which will be made available to cooperating agencies.
- ◆ All personnel employing immobilizing and euthanasia drugs will be properly trained and certified in the use of those chemicals. All immobilizing and euthanasia chemicals used by WS or other agencies will be securely stored and properly monitored to ensure the safety of the public. WS' use of immobilizing and euthanasia drugs and training requirements to use those chemicals are outlined in WS Directive 2.430.

3.5.4 Issue 4 - Humaneness of Management Methods

- ◆ Personnel will be well trained in the latest and most humane devices/methods for removing problem wildlife.
- ◆ All monkeys live-captured by WS will be relinquished to the DNER and/or the PRDA after capture. WS' may, at the request of the DNER and/or the PRDA, euthanize live-captured monkeys. WS' personnel will attempt to dispatch captured target animals, slated for lethal removal, as quickly and humanely as possible. WS' use of euthanasia methods will follow those recommended by WS' directives (WS Directive 2.430) and the AVMA for use on non-

human primates (AVMA 2007). The fate of live-captured monkeys by the DNER, the PRDA, or by the USFWS will be determined by those respective agencies.

- ◆ The NWRC is continually conducting research to improve the selectivity and humaneness of wildlife damage management devices used by personnel in the field.
- ◆ Trap monitoring devices will be employed where appropriate to minimize pain and distress of live-captured monkeys. All traps will be checked daily or as indicated by trap monitors which will minimize the amount of time wildlife may be confined.

3.5.5 Issue 5 - Effects of Management on the Aesthetic Values of Target Species

- ◆ Management actions to reduce or prevent damage caused by monkeys in Puerto Rico would be directed toward specific individuals identified as responsible for the damage, identified as posing a threat to human safety, or identified as posing a threat of damage.
- ◆ All methods or techniques applied to resolve damage or threats to human safety would be agreed upon by entering into a cooperative service agreement, MOU, or comparable document prior to the implementation of those methods.
- ◆ Monkeys in Puerto Rico are considered a non-native, invasive species in Puerto Rico that can cause harm to native flora and fauna, including threatened and endangered species. Any reduction in monkey populations could be viewed as benefiting the aesthetic value of a more native ecosystem.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

Chapter 4 provides information needed for making informed decisions in selecting the appropriate alternative to address the need for action described in Chapter 1. This chapter analyzes the environmental consequences of each alternative in relation to the issues identified. The following resource values within the Commonwealth of Puerto Rico are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, critical habitats (areas listed in T&E species recovery plans), visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. These resources will not be analyzed further.

4.2 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

This section analyzes the environmental consequences of each alternative in comparison to determine the extent of actual or potential impacts on the issues. Therefore, the proposed action/no action alternative serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration mandates, directives, and the procedures of WS and cooperating agencies.

Table 4-1 provides a comparison of the alternatives in relationship to the potential issues identified in Chapter 2.

4.2.1 Issue 1 - Effects on Invasive Monkey Populations in Puerto Rico

Alternative 1 – Integrated Wildlife Damage Management (Proposed Action/No Action)

Under this alternative, WS would incorporate non-lethal and lethal methods described in Appendix D in an integrated approach in which all or a combination of methods may be employed to resolve a request for assistance. Cooperating agencies would only conduct damage management actions after receiving a request from a property owner or property manager and would target those monkeys identified as causing damage on property owned or managed by the requestor after a cooperative agreement, MOU, or comparable document has been signed. Therefore, impacts to monkey populations in Puerto Rico could be variable and dependent on the number of requests received, the number of monkeys identified as causing damage, and the efficacy of the methods employed to resolve damage or threats.

Non-lethal methods can disperse or otherwise make an area unattractive to monkeys causing damage thereby, reducing the presence of monkeys at the site and potentially the immediate area around the site where non-lethal methods are employed. Non-lethal methods would be given priority when addressing requests for assistance. However, non-lethal methods would not necessarily be employed to resolve every request for assistance if deemed inappropriate by personnel of WS or cooperating agencies. Lethal methods would be employed to an individual or those individuals responsible for causing damage or threats to human safety. The use of lethal methods would therefore result in local population reductions in the area where damage or threats were occurring.

Monkeys in Puerto Rico and satellite islands have no known predators outside of humans (González-Martínez 1995). With no known predators, predation is not a limiting factor in monkey populations in Puerto Rico or satellite islands. Outside of natural mortality from age,

disease, and natural injuries, human caused mortality occurs primarily from agricultural producers who shoot marauding monkeys to protect agricultural resources. Additionally, some monkeys are likely lost due to the capture, trade, and sale of monkeys in Puerto Rico. The extent of mortality caused by humans or removal for illegal trading of monkeys is unknown. However, current population estimates show an expanding, increasing monkey population indicating that mortality and removal of monkeys from prior human activities is not limiting monkey populations in Puerto Rico.

On the Islet Santiago, Kessler et al. (1988) determined that the tetanus toxoid was a significant mortality factor in rhesus monkey populations on the island estimated at 19.5%. Researchers concluded that the rhesus monkeys on Islet Santiago had little or no natural immunity to tetanus toxins (Kessler and Rawlins 1984). Rabies is not known to be a major factor in controlling patas or rhesus monkey populations. The Indian mongoose is the primary source of rabies in Puerto Rico raising concerns that interactions between monkeys and mongoose in Puerto Rico could lead to exposure of monkeys to the virus. Impacts from mass exposure of monkeys to rabies are unknown.

File and Kessler (1989) found that intestinal and tissue parasites were not a major problem with rhesus on Islet Santiago. Parasite loads were highest in the younger age classes and tended to decrease with the age of the monkey (Knezevich 1998). Females were found to be less infested than males. Typical parasites found in rhesus on Islet Santiago included: *Strongyloides fuelleborni*, *Trichuris trichiura*, and *Balantidium coli*. On Islet Santiago, researchers believe that monkeys may be eating soil to reduce the impacts of parasites (Knezevich 1998).

Based on ecology studies of rhesus and patas monkeys conducted by González-Martínez (1995), the only apparent limiting factor in monkey populations in Puerto Rico is currently habitat and food resources. The current range expansion occurring in Puerto Rico of monkeys (Jensen et al. 2004, Massanet and Chism 2007, R. López-Ortiz, DNER, pers. comm. 2007), is indication that few limiting factors currently exist for monkeys in Puerto Rico. Habitat and food resources are currently sufficient to allow for population expansion.

Patas Monkey Populations in Puerto Rico

During ecology studies of the invasive monkey population in southwest Puerto Rico in the early 1990s, González-Martínez (1995) identified four groups of patas monkeys and several all-male groups consisting of approximately 120 individuals occupying an estimated 125 km² area along the Sierra Bermeja range and nearby areas. Recent population estimates of patas monkeys in southwest Puerto Rico, place the population at 550 to 600 individuals in 9 to 11 groups (Massanet and Chism 2007) which represents an increase of at least 350% since the patas population was estimated at 120 individuals from 1990 to 1993 by González-Martínez (1995). The mean group size has also increased from 26.7 individuals reported by González-Martínez (1995) to a preliminary estimate of 53.7 individuals (Massanet 2007). Massanet (2007) also reported that preliminary habitat use analyses indicated sightings of patas monkeys in urban areas which were previously thought to be areas avoided by monkeys in Puerto Rico (González-Martínez 1995). The range of patas has also increased (Massanet and Chism 2007) to comprise an area estimated at 800 km² in southwestern Puerto Rico (R. López-Ortiz, DNER, pers. comm. 2007).

Female patas monkeys are considered mature at 4-5 years, typically having a single menstrual cycle, and are seasonal or synchronous breeders with generally a single offspring in a polygynous mating system in the wild (Rowell and Hartwell 1978). The social structure of patas monkeys is

characterized by a single male with multiple females (Rowell and Richards 1979), however, this system is temporarily abandoned when the resident male is displaced and breeding by several males takes place (Ohsawa et al. 1993).

Patas monkeys are documented as having home ranges from 2,340 hectares to 3,200 hectares with females determining movement and sleeping sites. Trees chosen for sleeping in at night were a different shape from those used for day resting. Day resting trees had wide, low, spreading crowns, while sleeping trees were shorter with narrower crowns with few branches near the ground. At night, each patas (except dependent infants) slept in a separate tree. The effect of this behavior was that the groups were widely spread out at night, often over two hectares or more. A group never used the same sleeping trees on consecutive nights, so that it needed extensive woodland in its range just for sleeping (Chism and Rowell 1988).

Rhesus Monkey Populations in Puerto Rico

Rhesus monkeys are considered adults at six years of age. Average gestation period is 168 days and birthing occurs from February to May (Koford 1965). Breeding on Islet Santiago is thought to be correlated to rainfall (Rawlins and Kessler 1985). Bercovitch (1993) and Bercovitch and Clarke (1995) found evidence to suggest maturation occurred earlier in males of a higher social status than in low ranking males on Islet Santiago. McMillian (1989) found that young mature males had a better chance of reproductive success regardless of social rank. Berard et al. (1994) concluded sneaky mating tactics by males resulted in 45% of offspring siring. This would indicate that mate consortships are more productive when only a few females are in estrous and less successful when multiple females are in estrous simultaneously (Zorpette 1995, Berard 1999). Female reproductive success is thought to be more a product of survivorship and health rather than mate selection (Bercovitch 1997).

Male rhesus mortality tends to increase between ages two and six while female mortality tends to decrease during the same age period (Koford 1965). On the Islet of Santiago, the rhesus population growth rate has been estimated at 14% and 16% (Koford 1965, Rawlins et al. 1984, Rawlins and Kessler 1986). Annual mortality was estimated to be 6.7% for a 3-year period and mortality did not increase with an increase in density (Rawlins et al. 1984). Densities of provisioned monkeys on Islet Santiago were six times those of natural populations (≈ 13 animals/hectare). The same provisioned monkeys also supplemented their food intake with native vegetation on the island (Marriott et al. 1993).

González-Martínez (1995) found two troops of rhesus macaques in the Sierra Bermeja area consisting of 65-85 individuals and an unknown number of satellite males during investigations in southwest Puerto Rico from 1990 to 1993. The distribution of age and sex categories was as follows: 49% adult females, 34% juveniles and infants, 17% adult and young males. Additional troops of rhesus macaques were also found in the Cotuí area of San German and consisted of approximately 40-45 individuals. Rhesus densities in the Sierra Bermeja study area was estimated at 0.68 individuals/km² and within their calculated home range, 18.9 individuals/km² (González-Martínez 1995). Birthing season fell during the rainy season, April-August; mating season was during the dry season; November-March (Vandenbergh and Vessey 1968, González-Martínez 1995).

The current population of rhesus monkeys is unknown but appears to be restricted to the Sierra Bermeja range and a few other smaller groups along the periphery of the known range (R. López-Ortiz, DNER, pers. comm. 2007). Based on current trends observed with patas monkeys, the

population of rhesus monkeys has also likely increased from the approximately 105 to 130 individuals estimated by González-Martínez (1995).

Rhesus and patas monkeys have been classified as a non-native, invasive species in Puerto Rico that are negatively impacting resources and posing threats to human safety under Puerto Rico Regulation 6567 and Regulation 7399. Executive Order 13112 directs federal agencies whose actions may affect the status of invasive species to reduce invasion of those species and the associated damages to the extent practicable and permitted by law. Under this alternative, activities will occur to manage damage and threats associated with invasive monkeys in Puerto Rico when a request for assistance is received and a cooperative service agreement, MOU, or comparable document has been signed by a cooperating agency or agencies and the property owner or property manager. Monkeys located on National Wildlife Refuges owned by the USFWS may be completely removed from those areas to protect native wildlife and plants, including T&E species and to protect human safety.

The DNER has management authority of all wildlife species, including monkeys, in Puerto Rico under the New Wildlife Act of Puerto Rico (Law #241). The number of monkeys taken by cooperating agencies will be provided to the DNER for incorporation into management objectives for monkeys in Puerto Rico. Since the DNER regulates take of monkeys through the issuance of permits and MOUs, any reduction in the invasive monkey population in Puerto Rico would be at the direction of the DNER which views any reduction in the population of rhesus and patas monkeys as a beneficial impact to the native environment in Puerto Rico. Long-term objectives of the DNER could include the suppression or complete removal of monkeys from Puerto Rico. All activities to manage monkeys in Puerto Rico will be conducted pursuant to Executive Order 13112 and from the direction of the DNER through the issuance of permits. The DNER has expressed the intent and desire to suppress or remove invasive monkeys in Puerto Rico. Monkeys located on islands owned or operated by research facilities will be unaffected unless a request is received for assistance to reduce damages occurring by those monkeys.

Alternative 2 – Technical Assistance Only

Monkey populations in Puerto Rico would not be directly impacted by cooperating agencies from a program implementing a technical assistance program. However, persons experiencing damage or threats from invasive monkey populations may implement methods based on recommendations of cooperating agencies. WS and cooperating agencies would not be directly involved with any damage management program to resolve damage caused by monkeys in Puerto Rico. Those individuals interested in the use of non-lethal and lethal methods could use those methods to manage damage and threats to safety as deemed appropriate by the individual and as allowed by Commonwealth laws and regulations. Under a technical assistance only alternative, WS and cooperating agencies would recommend and demonstrate for use both non-lethal and lethal methods legally available to resolve monkey damage in Puerto Rico as described under the technical assistance section in section 3.2.1. Methods and techniques recommended would be based on WS' Decision Model and similar decision-making processes of cooperating agencies using information provided from the requestor or from a site visit to the damage area. Methods recommended would be those listed in Appendix D that are legally available to the requestor. Requestors may implement recommendations or take no action. However, those requesting assistance are likely those that would implement damage abatement methods recommended or would implement damage management methods in the absence of recommendations.

The illegal use of methods can occur from the inability of affected resource owners to reduce damage and associated losses which could lead to impacts on other wildlife populations and have unintended consequences. The illegal use of methods to resolve wildlife damage does occur and often has impacts to other wildlife species besides the targeted species (USDA 1997, White et al. 1989, USFWS 2001, FDA 2003). Therefore, under a technical assistance only alternative with no direct involvement by WS and cooperating agencies, monkeys could still be taken by those experiencing damage using methods legally available with the appropriate permits issued by the DNER and/or PRDA. Take would be variable depending on the expertise of those employing those methods and the number of monkeys causing damage. Under this alternative, monkey populations would likely continue to increase and damage would continue to occur.

Alternative 3 - No Monkey Damage Management in Puerto Rico

Under the no involvement alternative, WS and cooperating agencies would not recommend, demonstrate, or provide any equipment to those requesting assistance. Those requesting assistance would be provided information on cultural practices to reduce damage but no site visits would occur or recommendation of methods would occur. WS and cooperating agencies would have no direct involvement with any aspect of addressing damage caused by monkeys in Puerto Rico and would provide no technical assistance. No taking of monkeys would be allowed by the Commonwealth. Under this alternative, damage caused by monkeys would likely continue to increase as populations expand.

4.2.2 Issue 2 - Effects on Non-target Species Populations, Including T&E Species

Alternative 1 – Integrated Wildlife Damage Management (Proposed Action/No Action)

Potential Adverse Effects on Non-target Species

The potential adverse affects to non-targets occurs from the employment of methods to address monkey damage in Puerto Rico. Personnel from WS' and cooperating agencies are experienced and trained in wildlife identification and to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife, WS' and cooperating agencies would employ the most selective methods for the target species, would employ the use of attractants that are as specific to target species as possible, and determine placement of methods to avoid exposure to non-targets. Minimization methods and SOPs to prevent and reduce any potential adverse impacts on non-targets are discussed in section 3.5 of this EA. Despite the best efforts to minimize non-target take during program activities, the potential for adverse impacts to non-target exists when applying both non-lethal and lethal methods to manage damage or reduce threats to safety.

Non-lethal methods have the potential to cause adverse affects to non-targets primarily through exclusion, harassment, and dispersal. Any exclusionary device erected to prevent access of target species also potentially excludes species that are not the primary reason the exclusion was erected, therefore; non-target species excluded from areas may potentially be adversely impacted if the area excluded is large enough. The use of auditory and visual dispersal methods used to reduce damage or threats caused by target species are also likely to disperse non-targets in the immediate area the methods are employed. Therefore, non-targets may be dispersed from an area while employing non-lethal dispersal techniques. However, like target species, the potential impacts on non-target species are expected to be temporary with target and non-target species often returning after the cessation of dispersal methods.

Other non-lethal methods available for use under this alternative include drop nets, cannon nets, foothold traps, live traps, and immobilizing drugs. The use of drop nets and cannon nets are virtually selective for target individuals since activation occurs by attending personnel with handling of wildlife occurring after deployment of the net. Therefore, any non-targets captured using drop nets or cannon nets can be immediately released on site. Any potential non-targets captured using non-lethal methods would be handled in such a manner as to ensure the survivability of the animal if released. Even though live-capture does occur from those methods, the potential for death of a target or non-target animal while being restrained or released does exist, primarily from being stuck by the net during net deployment upon activation. The likelihood of non-targets being struck is extremely low and is based on being present when the net is activated and in a position to be struck. Nets are positioned to envelop wildlife upon deployment and to minimize striking hazards. Baiting of the areas to attract target species often occurs when using nets. Therefore, sites can be abandoned if non-target use of the area is high.

Foothold traps and live traps (e.g., cage traps, walk-in traps, corral traps) restrain wildlife once captured and are considered live-capture methods. Foothold traps and live traps have the potential to live-capture non-target species. Trap placement in areas where target species are active and the use of attractants as specific to the target species as possible will minimize the likelihood of capture of non-targets. Traps will be checked at least every 24 hours and in some cases, remote trap monitors will be used. With the checking of traps at least every 24 hours and through the use of trap monitors, any non-target species captured can be released on site. The checking of traps at least every 24 hours and the use of trap monitoring devices, pain and suffering of any non-targets captured can be minimized which will lessen the distress experience by the individual.

Immobilizing drugs are applied either after live-capture occurs through injection or are applied through direct application to target individuals from a dart gun, blow gun, or jabstick. Therefore, immobilizing drugs are only applied after identification of the target occurs prior to application. If immobilizing agents become available that can be formulated in or part of a bait, those applications will only occur in controlled situations. Controlled situations would include monkeys confined inside a live-trap where treated bait is placed inside the trap or placed in stations where monkeys have been conditioned to feed. In those controlled situations where monkeys are confined inside a large walk-in trap, treated bait would be placed inside after monkeys are live-captured through hand-baiting to immobilize and remove monkeys. When application occurs as part of feeding stations, non-targets would be excluded through the design of the feeding station and the site would be pre-baited to monitor for non-target use. Feeding stations would also be constantly monitored once bait is placed to address any immobilized monkeys. Therefore, monitoring of the site for non-targets will occur constantly when treated baits are present at the feeding station. All treated baits would be removed after each baiting session. No adverse impacts from immobilizing drugs to non-targets will occur.

The use of firearms is essentially selective for target species since animals are identified prior to application; therefore, no adverse impacts are anticipated from use of this method. Euthanasia drugs are applied directly to the target individual through injection only after that individual is properly restrained and immobilized. Therefore, euthanizing drugs will have no adverse impact on non-targets.

While every precaution is taken to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by wildlife, the use of

such methods can result in the incidental take of unintended species. These occurrences are rare and should not affect the overall populations of any species under the current program. WS' take of non-target species during activities to reduce damage or threats to human safety from invasive patas and rhesus monkeys in Puerto Rico is expected to be extremely low to non-existent. WS and cooperating agencies will monitor annually the take of non-target species to ensure program activities or methodologies used in monkey damage management do not adversely impact non-targets.

T&E Species Effects

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. Mitigation measures and SOPs to avoid T&E effects are described in section 3.5.2 of this EA.

USFWS Listed Species. The list of species designated as threatened and endangered in the Commonwealth of Puerto Rico as determined by the USFWS was obtained and reviewed during the development of this EA (see Appendix C). Consultation with the USFWS under Section 7 of the ESA concerning potential impacts of WS' programmatic activities on T&E species was conducted as part of the development of WS' programmatic FEIS. WS obtained a BO from the USFWS addressing WS' programmatic activities. For the full context of the BO, see Appendix F of WS' programmatic FEIS (USDA 1997). During the development of this EA, consultation with the USFWS under Section 7 of the ESA also occurred. After review of the T&E species in Puerto Rico and the activities described in this EA, including consultation with cooperating agencies, the proposed action was determined to not likely adversely impact any T&E species listed in Puerto Rico. The USFWS concurred with the determination that managing damage and threats associated with monkeys in Puerto Rico as described in this EA would not likely adversely affect T&E species in Puerto Rico.

Commonwealth Listed Species. The list of vulnerable or threatened and endangered species designated by the Commonwealth was also obtained during the development of this EA (see Appendix C). Based on the methods and scope of activities proposed under this alternative, activities conducted within the scope of analysis will not adversely affect any species listed as vulnerable or threatened and endangered in Puerto Rico.

Beneficial Effects on Non-target Species

Invasive species that are introduced into naïve environments often exploit resources and often compete with native plant and wildlife species. Competition for resources between invasive and native species has been well documented (Pimentel et al. 2000). Of major concern with resource agencies are the impacts invasive species have on T&E species. Pimentel et al. (2000) estimated 400 of the 958 species listed as threatened and endangered in the U.S. at the time of publication were negatively impacted by invasive species, primarily from competition for resources and predation based on published reports by The Nature Conservancy (1996) and Wilcove et al. (1998). Worldwide nearly 80% of wildlife populations at risk of extinction are threatened or negatively impacted by invasive species (Pimentel et al. 2005). Thus, invasive species have been identified as the primary cause of endangerment of at least 40% of the species listed as threatened or endangered in the U.S. (Wilcove et al. 1998, Pimentel et al. 2000, Pimentel et al. 2005).

The adverse impacts that monkeys can have on native flora and fauna in Puerto Rico are discussed in section of 1.3.3 of this EA. Any reduction in the invasive monkey population in

Puerto Rico could be viewed as benefiting native wildlife and habitats. González-Martínez (1995) found that 65% of the diet of monkeys in Puerto Rico consisted of native plant species or components of native plants species. There is also evidence that monkeys are feeding on native reptiles in Puerto Rico (Evans 1989, González-Martínez 1995).

Of particular concern are the potential impacts of monkeys on T&E species in Puerto Rico. As previously discussed in section 1.3.3 of this EA, several threatened and endangered species occur in areas or on islands where invasive monkeys occur. Anecdotal evidence suggests monkeys may have been responsible for the loss of eggs and chicks in artificial nesting structures erected for the endangered yellow-shouldered blackbird in Puerto Rico in 2002 (R. López-Ortiz, DNER, pers. comm. 2004). Other endangered bird species at risk of predation by invasive monkeys in Puerto Rico include the Puerto Rican nightjar (*Caprimulgus noctitherus*) and the Puerto Rican parrot. The Higo Chumbo is a federally listed cactus occurring on Desecheo Island which could be negatively impacted by the presence of invasive monkeys at that island. Monkeys have been documented as feeding on cactus plants on the island to obtain water (Morrison and Menzel 1972, Evans 1989). Given the potential for monkeys to negatively impact T&E species in Puerto Rico and satellite islands, any removal of monkeys could be benefiting the native ecosystems on the islands which would benefit non-target plants and wildlife.

Under this alternative, WS' and cooperating agencies would be allowed to integrated methods to achieve the most effective approach to resolve and prevent damage to native flora and fauna in Puerto Rico. An integrated approach allows the greatest amount of flexibility in the use of methods to ensure employment of methods either individually or in combination achieves the desired level of damage or threat reduction.

Alternative 2 – Technical Assistance Only

Under a technical assistance alternative, WS and cooperating agencies would have no direct impact on non-target species, including threatened and endangered species. Methods recommended or provided through loaning of equipment could be employed by those requesting assistance. Recommendations would be based on WS' Decision Model or the decision-making process of respective cooperating agencies using information provided by the person requesting assistance or through site visits. Recommendations would include methods or techniques to minimize non-target impacts associated with the methods being recommended or loaned. Methods recommended could include non-lethal and lethal methods as deemed appropriate by the issuing agency or agencies and as permitted by Commonwealth laws and regulations.

The potential impacts to non-targets under this alternative would be variable and based on several factors. If methods are employed, as recommended by WS and cooperating agencies, the potential impacts to non-targets are likely similar to the proposed action. If recommended methods and techniques are not followed or if other methods are employed not recommended, the potential impacts on non-target species, including T&E species is likely higher compared to the proposed action.

The only methods available to those requesting assistance would be most harassment methods, live traps, and possibly shooting if permitted by Commonwealth authorities. The potential impacts of harassment and exclusion methods to non-target species would be similar to those described under the proposed action. Harassment and exclusion methods are easily obtainable and simple to employ. An increase in the take of non-targets could occur from the use of live-traps recommend by WS and cooperating agencies if the requestor is not as diligent in monitoring

and checking the traps. Incorrect placement or the incorrect use of attractants to the trap could increase non-target capture and if the traps are not checked frequently, an increase take of non-targets could occur. If those implementing recommended live traps are diligent with checking and monitoring live traps, any non-targets captured could be released unharmed similar to the proposed action. Since identification of targets occurs when employing shooting as a method, the potential impacts to non-target species are likely low under this alternative.

Those experiencing damage from invasive monkeys may implement methods and techniques based on the recommendations of WS and cooperating agencies. The potential for impacts would be based on the knowledge and skill of those persons implementing recommended methods. Potential impacts from providing only technical assistance could be greater than those described in the proposed action if those experiencing damage do not implement methods or techniques correctly. Incorrectly implemented methods or techniques recommended by WS and cooperating agencies could lead to an increase in non-target take.

If requestors are provided technical assistance but do not implement any of the recommended actions, the potential impacts to non-targets would be lower compared to the proposed action. If those requesting assistance implement recommended methods appropriately and as instructed or demonstrated, the potential impacts to non-targets would be similar to the proposed action. Methods or techniques not implemented as recommended or used inappropriately would likely increase potential impacts to non-targets. Therefore, the potential impacts to non-targets, including T&E species would be variable under a technical assistance only alternative.

Alternative 3 - No Monkey Damage Management in Puerto Rico

Under this alternative, cooperating agencies would not be involved in invasive patas and rhesus monkey damage management. No direct impacts would be experienced by any wildlife species or populations. Efforts by municipal and/or natural resource managers and other entities could increase, which could result in impacts on non-target species populations to an unknown degree. Impacts on non-target species under this alternative would be variable depending on the level of effort and the skills and knowledge of the person implementing damage management methods.

4.2.3 Issue 3 - Effects of Management Methods on Human Health and Safety

4.2.3.1 Safety of Chemical Methods Employed

Alternative 1 – Integrated Wildlife Damage Management (Proposed Action/No Action)

Chemical methods available under an adaptive damage management program using an integrated approach are listed in Appendix D. Chemical methods are those regulated substances used for immobilizing and euthanasia. The primary application of immobilizing and euthanasia drugs occurs once a target species has been live-captured. Immobilization of live-captured monkeys will occur to minimize stress and the likelihood of injury to the individual monkey and for the safety of personnel handling the monkeys. Immobilizing drugs will be administered according to recommended methods and doses from published sources, through consultation with AC, and through research conducted by the NWRC. Kreeger et al. (2002) recommends 5.0 mg/kg of Telazol^{®8} for patas monkeys and 6.6 mg/kg Telazol[®] for rhesus monkeys with the same doses of ketamine recommended as a

⁸ Discussion, mention, or use of any product name does not constitute endorsement or imply any warranty by WS or cooperating agencies.

supplemental drug, respectively. Similar doses of ketamine recommended by Kreeger et al. (2002) were used to sedate patas and rhesus monkeys in Puerto Rico to fit radio collars during an ecology study (González-Martínez 1995). Evans (1989) also noted that live-captured monkeys were immobilized using ketamine hydrochloride given through intramuscular injection.

Administering immobilizing drugs to live-captured animals will occur primarily through injection of the drug once monkeys are live-captured and restrained but could also include the use of chemically treated baits for hand-baiting monkeys in live-capture devices or in areas where monkeys have been conditioned to feed on pre-bait. The use of chemically treated baits would occur in controlled situations where administration could be ensured to occur to target species only. Alpha-chloralose has not currently been evaluated for use for immobilizing monkeys. Alpha-chloralose is currently only available to WS for use to immobilize waterfowl and pigeons under an Investigational New Animal Drug (INAD) through the FDA. However, research could be conducted by NWRC to evaluate the application of alpha-chloralose as an immobilizing agent for monkeys live-captured in large walk-in style traps where confining monkeys to administer immobilizing drugs through injections would be difficult. In those situations, treated baits could be placed inside the live-trap to immobilizing monkeys for removal. Alpha-chloralose could also be used on treated baits after monkeys have been conditioned to feed at stations where non-targets use can be monitored or excluded. In those situations where alpha-chloralose would be used, all uneaten bait would be removed and monitoring of the site would occur continuously to address any monkeys immobilized.

González-Martínez (1995) used large baited walk-in traps to initially live-capture patas and rhesus monkeys in Puerto Rico and coaxed monkeys into squeeze-cages to restrain and immobilize monkeys using ketamine. Immobilizing drugs may also be administered through the use of pneumatic dart guns, blow gun, or injected using a jabstick, in those situations where deemed appropriate. The use of immobilizing drugs as part of an adaptive management program will pose no threat to human safety given the controlled situation of application. Drugs will be delivered directly through injection to restrained monkeys or by targeting individual monkeys through hand-baiting. Storage, transportation, and handling of all immobilizing drugs will be in accordance to WS' directives, directives of the respective cooperating agencies, FDA requirements, DEA requirements, and Commonwealth laws and regulations.

The final disposition of all patas and rhesus monkeys live-captured by WS will be determined by the DNER and/or the PRDA. If, after prior consultation with the DNER and/or PRDA, the fate of live-captured monkeys is determined to be humane euthanasia based on the availability of outlets for monkeys live-captured, the DNER and/or the PRDA may request WS to euthanize live-captured monkeys according to WS Directive 2.505. Euthanizing drugs would be administered through injection to immobilized monkeys. Euthanizing drugs proposed for use under this Alternative are also listed in Appendix D.

All personnel from the respective cooperating agencies who handle and administered drugs will be properly trained. For WS' personnel, all employees handling and administering immobilizing and euthanizing drugs are required to be trained according to WS Directive 2.430. Training and adherence to agency directives will ensure the safety of employees administering any drugs. Monkeys euthanized by WS or cooperating agencies will be disposed of by deep burial or incinerated to ensure the risks to human safety from euthanized

monkeys are minimal. All euthanasia will occur in the absence of the public to further minimize risks. Minimization measures and SOPs are further described in section 3.5 of this EA.

Alternative 2 – Technical Assistance Only

Under the technical assistance alternative, WS and cooperating agencies would not use chemical methods directly. Immobilizing and euthanasia drugs are the only chemical methods available when addressing damage and threats to human safety from monkeys. Immobilizing and euthanasia drugs are regulated by the DEA and the FDA and are not available to the general public for use. Without access to immobilizing or euthanizing drugs, those persons capturing monkeys using live-traps would be responsible for euthanizing or handling live-captured monkeys. Since immobilizing and euthanizing drugs would be unavailable under this alternative, a gunshot would be the primary method of euthanasia as permitted by the DNER and/or the PRDA. If transport of live-captured monkeys occurred, no immobilizing drugs would be available for use to minimize hazards to the handler. The inability of those employing methods to properly immobilize and euthanize captured monkeys would increase threats to human safety from bites, scratches, and contact with bodily fluids of monkeys. Threats to human safety would increase under this alternative compared to the proposed action.

Mechanisms are in place to ensure only appropriate persons have access to and are able to obtain immobilizing and euthanasia drugs. No other chemical agents are currently registered or available for reducing damage caused by monkeys.

If resource owners feel direct assistance is inadequate to resolve damage or threats to an appropriate level, the illegal use of chemicals could increase. The illegal use of chemicals to resolve wildlife damage does occur and often has impacts to other wildlife species besides the targeted species (USDA 1997, White et al. 1989, USFWS 2001, FDA 2003). The extent of the illegal use of chemicals if only technical assistance is provided is unknown though it would likely increase if affected resources owners are unable to resolve damage or threats adequately with methods recommended or legally available. An increase in the illegal use of chemicals could increase threats to human safety depending on the chemical used and the extent of the chemical use.

Alternative 3 – No Monkey Damage Management in Puerto Rico

Under the no program alternative, WS and cooperating agencies would not be involved in any aspect of managing damage associated with monkeys in Puerto Rico, including providing any technical assistance. Therefore, under this alternative, WS and cooperating agencies would have no impact on human safety due to the lack of involvement in damage management issues associated with monkeys.

Similar to the technical assistance only alternative, immobilizing and euthanizing drugs would not be available under this alternative to those experiencing damage or threats from monkeys in Puerto Rico. Therefore, the risks to human safety would likely be similar to alternative 2 but could be higher since no guidance or recommendation of proper methods and handling would occur under this alternative.

The illegal use of chemical methods would likely increase beyond those described for the technical assistance alternative in the absence of any assistance from cooperating agencies. The illegal use of chemical to address wildlife problems does occur. The extent or increase of illegal chemical use in the absence of any assistance by any agency is unknown.

4.2.3.2 Safety of Non-Chemical Methods Employed

Alternative 1 – Integrated Wildlife Damage Management (Proposed Action/No Action)

Non-chemical methods under the adaptive management alternative are listed in Appendix D. Non-chemical methods employed to reduce damage and threats to safety caused by monkeys, if misused, could potentially be hazardous to human safety. Non-chemical methods may include but are not limited to firearms, live-traps, foothold traps, and exclusion. A formal risk assessment of WS' operational non-chemical management methods found that risks to human safety were low (USDA 1997).

Safety issues due arise related to misusing firearms and the potential human hazards associated with firearms use when employed to reduce damage and threats. To help ensure safe use and awareness, WS' employees who use firearms to conduct official duties are required to attend an approved firearm safety training course and to remain certified for firearm use must attend a safety training course biannually (WS Directive 2.615). WS' employees who carry and use firearms as a condition of employment, are required to sign a form certifying that they have not been convicted of a misdemeanor crime of domestic violence. A thorough safety assessment will be conducted before firearms are deemed appropriate to alleviate or reduce damage and threats to human safety when conducting activities in Puerto Rico. Employees of the respective cooperating agencies will work closely with cooperators requesting assistance to ensure all safety issues are considered before the use of firearms are deemed appropriate for use. As stated previously, all methods, including firearms, must be agreed upon with the cooperator to ensure the safe use of methods.

The use of restraining devices such as foothold traps or live-capture traps have also been identified as a potential issue. Restraining devices are typically set in situations where human activity is minimal to ensure public safety. Restraining devices rarely cause serious injury and are triggered through direct activation of the device. Therefore, human safety concerns associated with restraining devices used to capture wildlife, including monkeys, require direct contact to cause bodily harm. Again, restraining devices are not located in high-use areas to ensure the safety of the public and pets. If appropriate, signs warning of the use of wildlife damage management tools in the area are posted for public view at access points to increase awareness that those devices are being used and to avoid the area, especially pet owners.

As stated previously, the cooperator requesting assistance is also made aware through a MOU, cooperative service agreement, or a similar document that those devices agreed upon could potentially be used on property owned or managed by the cooperator. An APHIS risk assessment in WS' programmatic FEIS concluded that threats to human safety from the use of devices to restrain wildlife were low (USDA 1997). Minimization measures and SOPs for non-chemical methods are discussed in section 3.5 of this EA.

Alternative 2 – Technical Assistance Only

Under the technical assistance alternative, cooperating agencies would recommend the use of available non-chemical methods for managing damage caused by monkeys. Recommendations would be made based on the appropriate agencies decision-making process and on information provided by the requester or from a site visit. The implementation of non-chemical methods would be the sole responsibility of the requester. Cooperating agencies would not be directly involved with managing damage caused by monkeys in Puerto Rico. Non-chemical methods available for use under the technical assistance only alternative would be limited to non-lethal harassment methods, exclusion, live-trapping, and shooting when permitted by the DNER and/or the PRDA.

If non-chemical methods are employed according to recommendations and as demonstrated by cooperating agencies, the potential risks to human safety would be similar to the proposed action. If methods are employed without guidance from cooperating agencies or applied inappropriately, the risks to human safety could increase. The extent of the increased risk would be unknown and variable. Non-chemical methods inherently pose minimal risks to human safety given the design and the extent of the use of those methods.

However, the immediate burden of employing non-chemical methods to resolve damage or threats would be placed on the individual requesting assistance. Therefore, the individual requesting assistance would be responsible for the handling and disposal of monkeys. Individuals requesting assistance are not likely to be properly trained in the handling of monkeys; therefore, the risk of disease transmission or injury to the handler increases considerably.

Alternative 3 – No Monkey Damage Management in Puerto Rico

Under the no monkey damage management alternative, cooperating agencies would not be involved with any aspect of managing damage associated with monkeys in Puerto Rico, including technical assistance. Due to the lack of involvement in managing damage caused by monkeys, no impacts to human safety would occur directly from any cooperating agency. This alternative would not prevent those entities experiencing threats or damage from monkeys from conducting damage management activities in the absence of cooperating agencies when permitted by the DNER and/or the PRDA. The direct burden of implementing permitted methods would be placed on those requesting assistance. Those persons requesting assistance are likely not trained in the proper handling and disposal of monkeys placing those implementing damage management methods at a higher risk of disease transmission or injury.

4.2.3.3 Effects of not Employing Methods to Reduce Threats to Human Safety

Alternative 1 – Integrated Wildlife Damage Management (Proposed Action/No Action)

Threats to human safety often occur due to interactions between people and invasive monkeys where a concern arises from transmission of zoonotic diseases or from physical interactions that result in injuries. In the absence of an effective program to address human safety threats associated with monkeys in Puerto Rico, the risks associated with disease

transmission and injuries will also likely increase especially if monkeys expand into urban areas where they may be tolerated initially resulting in a commensal relationship developing after monkeys become less apprehensive of humans and human activity. Though monkeys in Puerto Rico are not currently exhibiting commensal tendencies with people, their population and range expansion leading to commensalism is a concern (González-Martínez 1995, González-Martínez 1998, González-Martínez 2004). When monkeys live in close association with people, interactions between people and monkeys also increase which can lead to increased risks of disease transmission and physical injury. Disease threats and physical injuries associated with monkey-human interactions are discussed in section 1.3.1 of the EA.

Under the adaptive damage management alternative, methods deemed appropriate to resolve threats to human safety associated with monkeys would be employed by WS and cooperating agencies. All methods listed in Appendix D would be available for use to reduce threats to human safety. However, some methods may not be deemed appropriate due to local ordinances, safety concerns, or due to circumstances associated with the request. For example, monkeys posing threats to human safety in urban areas would likely limit the availability of methods available for use due to safety concerns with persons encountering live-captured monkeys or due to safety concerns of the methods to be employed, such as firearms.

Threats to human safety may not be completely eliminated under this alternative. However, under this alternative, methodologies would be available that would allow WS and cooperating agencies to address requests to reduce threats to human safety. Though measuring the reduction in threats to human safety of implementing the proposed action are difficult, it is reasonable to predict that using the adaptive damage management program using integrated methodologies would lower the degree of risks of threats to human safety given that the expertise of WS and other cooperating agencies in managing damage and threats will likely result in a reduction in the time necessary to resolve the threat. Reducing the time necessary to resolve the threat decreases the potential exposure time of the threat to humans which results in a reduction in the risks of interaction resulting in a human safety threat. Therefore, the duration of exposure would likely be shortened under this alternative by the use of integrated methods which would result in a reduction in the threat to human safety.

This alternative would allow personnel from WS and cooperating agencies to address threats to human safety associated with monkeys that are trained in the use of appropriate methodologies for addressing threats and are trained in the appropriate handling methods to ensure the safety of the handler and the public. The other alternatives would place the immediate burden of resolving threats to human safety on those requesting assistance which are not likely to be trained in the proper use of methods and are unaware of the proper handling of monkeys which would increase the threat of injury or disease transmission to the handler and to the public.

Alternative 2 – Technical Assistance Only

Under this alternative, WS and cooperating agencies would provide assistance to requestors by providing information regarding monkeys, on the availability of methods, and the proper use of methods available to the requestor. Methods recommended would be based on the respective agencies decision-making process.

Threats to human safety under the technical assistance alternative could be resolved by those persons implementing methods recommended by WS. The effectiveness in reducing threats would be based on the knowledge of the person to effectively implement the methods and knowledge of the behavior of the target species that would increase the likelihood of resolving the threat. The ability to resolve threats to human safety by those requesting technical assistance would also be dependant upon the availability of methods and the effectiveness of those methods, and the ability of the requestor to acquire those methods.

Given the expertise of cooperating agencies in the behavior of the target species and the knowledge in the effective use of available methods, the potential threats to human safety under this alternative is likely higher than the proposed action. Under this alternative, those requesting assistance would be responsible for implementing and using methods to resolve damage or threats which places the requestor at a high risk of exposure to disease and injury if not trained appropriately. The degree in which the risk is higher is unknown and is likely highly variable.

Alternative 3 – No Monkey Damage Management in Puerto Rico

Under this alternative, no assistance would be provided to those experiencing damage or threats associated with monkeys in Puerto Rico. In the absence of any assistance, those needing assistance with managing damage or threats would be directly responsible for obtaining and employing the appropriate methods. Those persons employing methods would be at a higher risk of exposure to zoonotic diseases and injury since no guidance or recommendations would be made by any agency. Risks to human safety under this alternative would be greater than those risks in alternative 1 and alternative 2.

4.2.4 Issue 4 - Humaneness of Management Methods

Alternative 1 – Integrated Wildlife Damage Management (Proposed Action/No Action)

As discussed in section 2.3.4, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering.

Some individuals believe any use of lethal methods to resolve damage associated with wildlife is inhumane because the resulting fate is the death of the animal. Others believe that certain lethal methods can lead to a humane death. Others believe most non-lethal methods of capturing wildlife to be humane because the animal is generally unharmed and alive. Still others believe that any disruption in the behavior of wildlife is inhumane. With the multitude of attitudes on the meaning of humaneness and the varying perspectives on the most effective way to address damage and threats in a humane manner, agencies are challenged with conducting activities and employing methods that are perceived to be humane while assisting those persons requesting assistance to manage damage and threats associated with wildlife. The goal of WS and cooperating agencies is to use methods as humanely as possible to effectively resolve requests for assistance to reduce damage and threats to human safety. WS and cooperating agencies continue to evaluate methods and activities to minimize the pain and suffering of methods addressed when attempting to resolve requests for assistance.

As mentioned previously, some methods have been stereotyped as "humane" or "inhumane". However, many "humane" methods can be inhumane if not used appropriately. For instance, a cage trap is generally considered by most members of the public as "humane". Yet, without

proper care, live-captured wildlife in a cage trap can be treated inhumanely if not attended to appropriately.

Therefore, the goal is to effectively address requests for assistance using methods in the most humane way possible that minimizes the stress and pain of the animal. Traps designed to restrain monkeys by the foot will be padded to minimize injury (e.g., padded foothold trap). However, enclosed foothold traps as described in Appendix D that are not steel-jawed traps will not be padded. All trapping efforts that do not require direct application (e.g., drops nets, cannon nets) will be monitored daily to ensure live-captured wildlife are addressed quickly to ensure a minimal amount of pain and suffering occurs. Live-capture methods will be fitted with trap monitoring devices, when appropriate, that indicate the trap has been activated. By imposing a required 24-hour trap check and through the use of trap monitoring devices, the amount of time an animal is confined by a trap will be decreased which will minimize the distress experienced by the animal.

WS' may, at the request of the DNER and/or the PRDA, euthanize live-captured monkeys. WS' use of euthanasia methods will follow those required by WS' directives (WS Directive 2.430) and recommended by the AVMA for use on non-human primates (AVMA 2007). The fate of live-captured monkeys by the DNER, the PRDA, or by the USFWS will be determined by those respective agencies and the use of euthanasia techniques will be governed by the directives of the respective agencies.

Personnel of the respective agencies that employ firearms to address monkey damage or threats to human safety in Puerto Rico will be trained in the proper placement of shots to ensure a timely and quick death.

Research and development by WS' and cooperating agencies has improved the selectivity and humaneness of management techniques. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations where non-lethal damage management methods are not practical or effective. Personnel from WS and cooperating agencies are experienced and professional in their use of management methods. Consequently, management methods are implemented in the most humane manner possible under the constraints of current technology. Minimization measures and SOPs used to maximize humaneness are listed in Chapter 3.

Alternative 2 – Technical Assistance Only

The issues of humaneness of methods under this alternative are likely to be perceived to be similar to humaneness issues discussed under the proposed action. This perceived similarity is derived from the recommendation of methods that some consider inhumane. Cooperating agencies would not be directly involved with damage management activities under this alternative. However, the recommendation of the use of methods would likely result in the requestor employing those methods. Therefore, by recommending methods and thus a requestor employing those methods the issue of humaneness would be similar to the proposed action.

WS and cooperating agencies would instruct and demonstrate to the requestor the proper use and placement of methodologies to increase effectiveness in capturing target wildlife and to ensure

methods are used in such a way as to minimize pain and suffering of captured wildlife. However, the efficacy of methods employed by a cooperators would be based on the skill and knowledge of the requestor in resolving the threat to safety or damage situation despite the demonstration of proper placement and use. Therefore, a lack of understanding of the behavior of the target species or properly identifying the damage caused by the target species along with inadequate knowledge and skill in using methodologies to resolve the damage or threat could lead to incidents with a greater probability of being perceived as inhumane. In those situations, the pain and suffering are likely to be regarded as greater than those discussed in the proposed action.

Those requesting assistance would be directly responsible for the use and placement of methods and if monitoring or checking of those methods does not occur in a timely manner, captured wildlife could experience suffering and if not address timely, could experience distress. The amount of distress experience by captured wildlife would likely be higher under this alternative compared to the proposed action since methods used to capture wildlife would be checked at least every 24-hours and would be monitored, when appropriate, using trap monitor devices. Thus, the amount of time an animal is restrained under the proposed action will be shorter compared to a technical assistance alternative if those requestors implementing methods are not as diligent or timely in checking methods.

Alternative 3 – No Monkey Damage Management in Puerto Rico

Under this alternative, the issues of the humaneness of methods would not be considered by WS and cooperating agencies. WS and cooperating agencies would have no involvement in any aspect of monkey damage management in Puerto Rico. Those experiencing damage or are threatened by monkeys could use those methods legally available and permitted by the DNER and/or PRDA. Those methods would likely be considered inhumane by those persons who would consider methods proposed under any alternative as inhumane. The issue of humaneness would likely be directly linked to the methods legally available to the general public since methods are often labeled as inhumane by segments of society no matter the entity employing those methods.

Similar to the technical assistance alternative, the efficacy and therefore, the humaneness of methods would be based on the skill and knowledge of the person employing those methods. A lack of understanding of the target species or methods used could lead to an increase in situations perceived as being inhumane to wildlife despite the method used. Despite the lack of involvement by WS and cooperating agencies under this alternative, those methods perceived as inhumane by certain individuals and groups would still be available to the general public to use to resolve damage and threats caused by monkeys.

4.2.5 Issue 5 - Effects of Management on the Aesthetic Values of Target Species

Alternative 1 – Integrated Wildlife Damage Management (Proposed Action/No Action)

Under the proposed action, methods would be employed that would result in the dispersal, exclusion, or removal of individuals or small groups of monkeys to resolve damage and threats associated with monkeys in Puerto Rico. In some instances where monkeys are dispersed or removed, the ability of interested persons to observe and enjoy monkeys will likely temporarily decline. The monkey populations in those areas will likely increase upon cessation of damage management activities.

Even the use of exclusionary devices can lead to dispersal of wildlife if the resource being damaged was acting as an attractant. Thus, once the attractant has been removed or made unavailable, the wildlife will likely disperse to other areas where resources are more vulnerable.

The use of lethal methods would result in temporary declines in local populations resulting from the removal of monkeys to address or prevent damage and threats. The goal under the proposed action is to respond to requests for assistance and to manage those monkeys responsible for the resulting damage. Therefore, the ability to view and enjoy monkeys in Puerto Rico will still remain if a reasonable effort is made to locate monkeys outside the area in which damage management activities occurred.

On those National Wildlife Refuges owned or managed by the USFWS, invasive monkeys may be completely removed to protect native plants and wildlife, including T&E species, and to protect human safety. In those situations where monkeys are completely removed from Refuges owned by the USFWS the ability to view and enjoy monkeys would no longer be available. However, the ability to view native wildlife and plants, including T&E species, would likely increase if those species were being suppressed or displaced by the presence of invasive monkeys. The DNER has management authority over monkeys in Puerto Rico and can regulate take through the issuance of permits. With the various aesthetic values expressed by the public, some people may view monkeys as aesthetically displeasing given monkeys are an invasive species that cause damage to the native ecosystems, cause damage to agricultural resources, and pose threats to human safety. Some segments of the public find aesthetic enjoyment just knowing monkeys are free-ranging in Puerto Rico and that viewing opportunities exist with removal of even a single individual lessening the aesthetic value of monkeys. The aesthetic value of monkeys is likely dependent upon the real or perceived impacts those monkeys have on an individual. With the range of aesthetic values expressed in Puerto Rico, balancing the aesthetic values of the public can be difficult.

As stated previously, Executive Order 13112 directs federal agencies whose actions may affect the status of invasive species to reduce invasion of those species and the associated damages to the extent practicable and permitted by law. All activities are conducted where a request for assistance has been received and only after agreement for such services has been agreed upon by the cooperator. Some loss of aesthetic value would be gained by the removal of an invasive species and the return of a more natural environment, including the return of native wildlife and plant species that may be suppressed or displaced by the presence of invasive monkeys. Any suppression or reduction in monkey populations in Puerto Rico would occur at the direction of the DNER.

Alternative 2 – Technical Assistance Only

Under this alternative, the effects on the aesthetic values of monkeys in Puerto Rico would be similar to those addressed in the proposed action. Those persons requesting assistance have often reached a damage-level that has exceeded the economic threshold of that individual and therefore, the social acceptance level of monkeys has reached a level where assistance is required. Based on recommendations, methods are likely to be employed by the requestor based on those recommendations that will result in the dispersal and/or removal of those individuals of a monkey population responsible for damage or threatening safety.

The impacts on aesthetics from a technical assistance program would only be lower than the proposed action if those individuals experiencing damage are not as diligent in employing those

methods as cooperating agencies would be if conducting an operational program. If those experiencing damage abandoned the use of those methods then monkeys would likely remain in the area and available for viewing and enjoying for those interested in doing so.

Alternative 3 – No Monkey Damage Management in Puerto Rico

Under the no monkey damage management alternative, the actions of WS and cooperating agencies would have no impact on the aesthetic value of monkeys in Puerto Rico. Those experiencing damage or threats from monkeys in Puerto Rico would be responsible for researching, obtaining, and using all methods as permitted by the DNER and/or the PRDA. The degree to which damage management activities would occur in the absence of assistance by any agency is unknown but likely lower compared to damage management activities that would occur where some level of assistance was provided. Monkeys could still be disperse or removed under this alternative. The potential impacts on the aesthetic values of monkeys could be similar to the proposed action if similar levels of damage management activities are conducted by those experiencing damage or threats. If no action is taken or if activities are not permitted by the DNER and/or the PRDA, then no impact on the aesthetic value of monkeys would occur under this alternative.

4.3 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE

Cumulative impacts, as defined by CEQ (40 CFR 1508.7), are impacts to the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts may result from individually minor, but collectively significant, actions taking place over time. No significant or cumulative adverse environmental consequences resulting from the proposed action are anticipated.

Under Alternatives 1 and Alternative 2, WS and cooperating agencies would address damage associated with invasive patas and rhesus monkeys in a number of situations throughout the Commonwealth of Puerto Rico. WS, the DNER, and the PRDA would be the primary agencies conducting monkey damage management in the Commonwealth of Puerto Rico. The USFWS will conduct monkey damage management on property they own or manage and may seek assistance, either operational or technical, from WS, the DNER, and/or the PRDA. Since all wildlife, including monkeys are protected under Commonwealth law, the take of monkeys by other entities will only occur as permitted by the DNER and/or the PRDA. Through ongoing coordination and collaboration between WS, the DNER, the PRDA, and the USFWS, activities of each agency will be available. Monkey damage management activities in the Commonwealth of Puerto Rico will be monitored annually to evaluate and analyze activities to ensure those activities are within the scope of analysis of this EA.

4.3.1 Issue 1 - Effects on Invasive Monkey Populations in Puerto Rico

Evaluation of activities relative to target species indicated that program activities will likely have no cumulative adverse affects on monkey populations in the Commonwealth of Puerto Rico when targeting those species responsible for the damage. WS' actions would be occurring simultaneously, over time, with other natural processes and human generated changes that are currently taking place. These activities include, but are not limited to:

- Natural mortality of monkeys
- Human-induced mortality of monkeys through private damage management activities

- Human and naturally induced alterations of wildlife habitat
- Annual and perennial cycles in wildlife population densities

All those factors play a role in the dynamics of monkey populations. In many circumstances, requests for assistance arise when some or all of those elements have contrived to elevate target species populations or place target species at a juncture to cause damage to resources. The actions taken to minimize or eliminate damage are constrained as to scope, duration, and intensity for the purpose of minimizing or avoiding impacts to the environment. WS and cooperating agencies evaluates damage occurring, including other affected elements and the dynamics of the damaging species; determines appropriate strategies to minimize effects on environmental elements; applies damage management actions; and subsequently monitors and adjusts/ceases damage management actions (Slate et al. 1992). This process allows WS and cooperating agencies to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse impacts on target species.

Patas and rhesus monkeys in Puerto Rico have been designated as invasive species which are negatively impacting resources, including natural resources, and potentially threatening human safety under Commonwealth of Puerto Rico Regulation 7399 and Regulation 6765. Executive Order 13112 directs federal agencies whose actions may affect the status of invasive species to reduce invasion of those species and the associated damages to the extent practicable and permitted by law. Activities are only conducted after a request for assistance has been received by a government or private entity and only after a cooperative service agreement, MOU, or comparable document has been signed.

Patas are native to Africa with the population in southwest Puerto Rico originating from populations in Nigeria (González-Martínez 1995). However, there is currently no information indicating that patas monkey populations in Africa are severely declining to the point that the removal of invasive monkeys from Puerto Rico would cumulatively impact populations worldwide. Similarly, rhesus monkeys are common throughout Afghanistan, India, China, and Southeast Asia where they are considered native with no evidence that populations are severely declining in those countries. Patas and rhesus monkeys are commonly found at primate research facilities, including those research facilities and colonies found in the Commonwealth of Puerto Rico. The removal of rhesus and patas monkeys from where they are considered an invasive species will not cumulatively impact populations where those monkeys are considered native.

4.3.2 Issue 2 - Effects on Non-target Species' Populations, including T&E Species

Potential effects on non-target species from conducting monkey damage management arise from the use of non-lethal and lethal methods to alleviate or prevent those damages. The use of non-lethal methods during activities to reduce or prevent damage caused by monkeys has the potential to exclude, disperse, or capture non-target wildlife. However, the effects of non-lethal methods are often temporary and often do not involve the take of non-target wildlife species. When using exclusion devices, both target and non-target wildlife can be prevented from accessing the resource being damaged. Since exclusion does not involve lethal take, cumulative impacts on non-target species from the use of exclusionary methods will not occur but would likely disperse those individuals to other areas. Exclusionary methods are often expensive and require constant maintenance to ensure effectiveness. Therefore, the use of exclusionary devices will be somewhat limited to small, high-value areas and not used to the extent that non-targets are excluded from large areas that would cumulatively impact populations from the inability to access a resource, such as potential food sources or nesting sites. The use of visual and auditory harassment and dispersion

methods are generally temporary with non-target species returning after the cessation of those activities. Dispersal and harassment do not involve the take of non-target species and similar to exclusionary methods are not used to the extent or at a constant level that would prevent non-targets from accessing critical resources that would threaten survival of a population.

The use of lethal methods or those methods used to live-capture target species followed by euthanasia also have the potential to impact non-target wildlife through the take or capture of non-target species. Capture methods used are often methods that are set to confine or restrain target wildlife after being triggered by a target individual. Capture methods are employed in such a manner as to minimize the threat to non-target species by placement in those areas frequently used by target wildlife, using baits or lures that are as species specific as possible, and modification of individual methods to exclude non-targets from capture. Most methods described in Appendix D are methods that are employed to confine or restrain wildlife that are subsequently euthanized using humane methods. With all methods checked at least every 24-hours and the use of trap monitors when appropriate under the proposed action, non-target wildlife captured can be released on site if determined to be able to survive following release. Minimization and SOPs are intended to ensure take of non-target wildlife is minimal during the use of methods to capture target wildlife.

The use of firearms, immobilizing chemicals, and euthanasia chemicals are essentially selective for target species since identification of an individual is made prior to the application of the method. Euthanasia chemicals are applied through direct injection in to target wildlife. Immobilizing chemicals are also directly injected in target wildlife but for chemicals could be applied through hand-baiting if found to be appropriate and safe through future research. Therefore, the use of those methods will not impact non-target species.

The methods described in Appendix D all have a high level of selectivity and can be employed using SOPs and minimization measures to ensure impacts to non-targets are minimal. Therefore, take under the proposed action of non-targets will not cumulatively impact non-target species. Cumulative impacts will be minimal on non-targets from any of the alternatives discussed.

4.3.3 Issue 3 - Effects of Management Methods on Human Health and Safety

Non-Chemical Methods

All non-chemical methods described in Appendix D are used within a limited time frame, are not residual, and do not possess properties capable of inducing cumulative adverse impacts on human health and safety. All non-chemical methods are used after careful consideration of the safety of those employing methods and to the public. All capture methods are employed in areas where human activity is minimal and warnings signs are placed in conspicuous areas, when appropriate, to ensure the safety of the public. Capture methods also require direct contact to trigger ensuring that those methods, when left undisturbed will have no effect on human safety. All methods are agreed upon by the requesting entities which are made aware of the safety issues of those methods when entering into a MOU, cooperative service agreement, or other comparable document with WS and cooperating agencies. SOPs and minimization measures also ensure the safety of the public from those methods used to capture or take wildlife. A formal risk assessment conducted by APHIS determined that WS'

non-chemical methods, when used as intended, poses a low risk to human safety (USDA 1997). Firearms used to alleviate or prevent damage, though hazards do exist, are employed to ensure the safety of employees and the public. Based on the use of non-chemical methods, those methods will not cumulatively impact human safety.

Chemical Methods

Chemical methods available for use under the proposed action are immobilizing and euthanizing drugs described in Appendix D. Immobilizing drugs are administered to target individuals using devices or methods that ensure the identification of the target animal. The immobilizing drugs discussed in Appendix D require injection of the drug directly into an animal or through ingestion of treated bait. Injection would occur through hand injection through a syringe, by jabstick, or by a pneumatically propelled dart that mechanically injects the drug into the animal upon impact. Treated baits are administered through hand-baiting for target individuals and designed to provide a single dose to the targeted individual to ensure sedation and avoid overdose. Currently, no immobilizing drugs are available for use through hand-baiting on treated baits. However, if through research, immobilizing drugs become available that can be formulated on or inside treated bait, the use of treated baits could be used. If available, all treated baits would be removed after each application to minimize risks to human safety. Immobilizing drugs temporarily sedate an animal to minimize stress of handling and reduces the risks to human safety. Immobilized animals may also be euthanized using a euthanizing drug described in Appendix D. Euthanasia drugs would only be administered after the monkey has been properly restrained and immobilized and would occur through direct injection through a syringe. WS' personnel are required to attend training courses and be certified in the use of immobilizing and euthanizing drugs to ensure proper care and handling occurs, to ensure the proper doses is administered, and to ensure human safety. Personnel of cooperating agencies will also be trained in the proper handling and administering of immobilizing and euthanasia drugs to ensure human safety.

Direct application of chemical methods to target species will ensure that there are no cumulative impacts to human safety. All chemical methods will be tracked and recorded to ensure proper accounting of used and unused chemicals occurs. All chemicals will be stored and transported according to FDA and DEA regulations, including the directives of the cooperating agencies. The amount of chemicals used or stored by WS and cooperating agencies will be minimal to ensure human safety. Based on this information, the use of chemical methods as part of the proposed action by WS and cooperating agencies will not have cumulative impacts on human safety.

4.3.4 Issue 4 - Humaneness of Management Methods

WS and cooperating agencies continue to seek new methods and ways to improve current technology to improve humaneness of methods used to manage damage caused by wildlife. Cooperation with individuals and organizations involved in animal welfare continues to be an agency priority for the purpose of evaluating strategies and defining research aimed at developing humane methods.

All methods not requiring direct supervision during employment (e.g., live traps, foothold traps) will be checked and monitored at least every 24 hours to ensure any wildlife confined or restrained are addressed in a timely manner to minimize distress of the animal. Trap monitoring devices will also be used that indicate when traps have been triggered which will allow for traps in remote location to be monitored daily and any wildlife captured to be addressed quickly. Open-faced foothold traps will have padded jaws to minimize pain of captured wildlife. Live-captured monkeys will be immobilized to minimize stress of handling. All euthanasia methods used for live-captured monkeys will be applied according to AVMA guidelines for non-human primates. Shooting will occur in limited

situations and personnel will be trained in the proper use of firearms to minimize pain and suffering of monkeys taken by this method.

WS and cooperating agencies are employing methods as humanely as possible by applying measures to minimize pain and that allow wildlife captured to be addressed in a timely manner to minimize distress. Through the establishment of minimization measures and SOPs that guide WS and cooperating agencies in the use of methods to address damage and threats associated with monkeys in Puerto Rico, the cumulative impacts on the issue of method humaneness are minimal. All methods will be evaluated annually to ensure measures and SOPs are adequate to ensure those methods continue to be used to minimize suffering and that wildlife captured are addressed in a timely manner to minimize distress.

4.3.5 Issue 5 - Effects of Management on the Aesthetic Values of Target Species

The activities of the cooperating agencies would result in the removal of monkeys from those areas where damage or threats were occurring. Therefore, the aesthetic value of monkeys in those areas where damage management activities were being conducted would be reduced. Monkeys are considered an invasive species in the Commonwealth of Puerto Rico which can negatively impact the natural environment. On those properties owned or managed by the USFWS, all monkeys could be removed to protect native plants and wildlife, including T&E species. On those areas where complete removal would occur, the aesthetic value of monkeys would be eliminated. However, for some people, the aesthetic value of a more natural environment would be gained by the removal of an invasive species, including the return of native wildlife and plant species that may be suppressed or displaced by the presence of monkeys. Monkeys are currently known to occur on the Desecheo Island National Wildlife Refuge on the remote island of Desecheo which is owned by the USFWS. Complete removal of monkeys from the island could occur to re-establish nesting by colonial waterbirds and to protect native plants and wildlife, including T&E species on the island. Access to the island is limited and the public is restricted from the island. Therefore, the complete removal of monkeys from the island would have no impact on the aesthetic value of monkeys on that refuge since the public has no access or opportunity to view or enjoy monkeys on the island.

Some people experience a decrease in aesthetic enjoyment of wildlife because they feel that overabundant species are objectionable and interfere with their enjoyment of wildlife in general, especially when those species are non-native to the natural environment. Continued increases in numbers of individuals or the continued presence of an invasive species may lead to further degradation of some people's enjoyment of any wildlife or the natural environment. The actions of WS and cooperating agencies could positively affect the aesthetic enjoyment of wildlife for those people that are being adversely affected by the target species identified in this EA.

Executive Order 13112 directs federal agencies whose actions may affect the status of invasive species to reduce invasion of those species and the associated damages to the extent practicable and permitted by law. The DNER and PRDA have regulatory authority over wildlife species in Puerto Rico and permit monkey damage management activities within the Commonwealth under that authority. Therefore, WS will rely on the collective direction of the DNER and PRDA on the need for long-term suppression or removal of monkeys from Puerto Rico since federal agencies are directed to reduce the invasion and damages associated with non-native species under Executive Order 13112. Therefore, the activities of WS and cooperating agencies are not expected to have any cumulative adverse affects on this element of the human environment if occurring at the request of the governmental agencies responsible for regulating an invasive species. The aesthetic value for those that enjoy viewing or knowing monkeys are present in Puerto Rico would be diminished under any of

the alternatives if monkey population are suppressed or removed from Puerto Rico as allowed by the DNER and the PRDA.

4.4 ADDITIONAL ANALYSES OF POTENTIAL CUMULATIVE IMPACTS

4.4.1 Irreversible and Irretrievable Commitments of Resources

Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

4.4.2 Effects on Sites or Resources Protected under the National Historic Preservation Act

Actions of WS and cooperating agencies are not undertakings that could adversely affect historic resources.

4.5 SUMMARY OF CUMULATIVE IMPACTS

No significant cumulative environmental impacts are expected from any of the three alternatives, including the proposed action. Under the proposed action, the lethal removal of invasive patas and rhesus monkeys by WS and cooperating agencies would not have significant impacts on the world-wide monkey population. No risk to public safety is expected when activities are provided and accepted by requesting individuals in Alternative 1 and Alternative 2 since only trained and experienced personnel would conduct and recommend damage management activities. There is a slight increased risk to public safety when persons who reject assistance and recommendations in Alternative 1 and Alternative 2 and conduct their own activities, and when no assistance is provided in Alternative 3. In all Alternatives, however, it would not be to the point that the impacts would be significant. Although some persons will likely be opposed to invasive patas and rhesus monkey damage management activities in the Commonwealth of Puerto Rico, the analysis in this EA indicates that an integrated approach to management damage and threats caused by invasive monkeys in Puerto Rico will not result in significant cumulative adverse impacts on the quality of the human environment. Table 4-1 summarizes the expected impact of each of the alternatives on each of the issues.

Table 4-1. Summary of the potential effects of the Alternatives as it pertains to the identified issues.

ISSUES	ALTERNATIVE 1. ADAPTIVE INTEGRATED WILDLIFE DAMAGE MANAGEMENT (PROPOSED ACTION/NO ACTION)	ALTERNATIVE 2. TECHNICAL ASSISTANCE ONLY	ALTERNATIVE 3. NO MONKEY DAMAGE MANAGEMENT IN PUERTO RICO
ISSUE 1 - EFFECTS ON INVASIVE MONKEY POPULATIONS IN PUERTO RICO	Invasive monkey populations would be reduced or removed in certain areas in Puerto Rico. Patas and rhesus populations in native areas of the world would not be negatively impacted.	No impact directly from WS or cooperating agencies. Impacts to invasive monkey populations in Puerto Rico likely similar to or lower than Alternative 1 depending on the skill and knowledge of those employing methods, including the ability to implement methods and recommendations of cooperating agencies. Patas and rhesus populations in native areas of the world would not be negatively impacted.	No direct impact would occur from WS or cooperating agencies. Impacts to invasive monkey population in Puerto Rico could be similar to or lower than Alternative 1 and Alternative 2 depending on the skills and abilities of those employing methods. Patas and rhesus populations in native areas of the world would not be negatively impacted.
ISSUE 2 - EFFECTS ON NON-TARGET SPECIES POPULATIONS, INCLUDING T&E SPECIES	No Impact to Minimal Impact - Methods available are highly selective with very little risk to non-target species. Minimization measures and SOPs ensure impacts are minimal.	Minimal Impact to Moderate Impact - No direct impact from WS or cooperating agencies. Methods recommended would be highly selective with very little risk to non-target species. Illegal use of methods or improper use of methods could lead to higher risks to non-targets.	Minimal Impact to Moderate Impact - No direct impact by WS and cooperating agencies. Impact would be based on the skill and knowledge of those implementing methods. Illegal use of methods or improper use of methods could lead to higher risks to non-targets.
ISSUE 3 - EFFECTS OF MANAGEMENT METHODS ON HUMAN HEALTH AND SAFETY	Low Risk – Minimization and SOPs for method use in place to ensure the safety of the public.	Low Risk to Moderate Risk – If methods employed as recommended, impact similar to Alternative 1. Public responsible for handling and euthanizing monkeys. Chemical immobilization and euthanization unavailable which increases risks to human safety from handling monkeys.	Low Risk to Moderate Risk – Public responsible for handling and euthanizing monkeys. Chemical immobilization and euthanization unavailable which increases risks to human safety from handling monkeys.
ISSUE 4 - HUMANENESS OF MANAGEMENT TECHNIQUES	Low to Moderate Impact – Methods used would be as humane as possible. Minimization measures and SOPs in place to address humaneness. Methods viewed by some people as inhumane would be used by WS and cooperating agencies.	Low to Moderate Impact – If methods employed as recommended, impact similar to Alternative 1. If methods used inappropriately or incorrectly, could lead to inhumane conditions. Methods recommended by WS and cooperating agencies viewed by some people as inhumane.	Low to Moderate Impact – If methods employed as correctly without guidance from WS and cooperating agencies, impacts similar to Alternative 1. If methods used inappropriately or incorrectly, could lead to inhumane conditions.
ISSUE 5 - EFFECTS OF MANAGEMENT ON THE AESTHETICS VALUES OF TARGETED SPECIES	Low Impact – Goal to remove monkeys causing damage or posing threats; complete removal or suppression could occur at the direction of the DNER and/or PRDA. Aesthetic value of monkey removal offset by increase in aesthetic value of removal of an invasive species	Low Impact – Monkeys removed from damage management areas as permitted. The DNER and/or the PRDA could permit activities that would remove or suppress populations. The aesthetics of a natural environment would continue to be diminished if invasive species allowed to expand	Low Impact – Monkeys removed from damage management areas as permitted. The DNER and/or the PRDA could permit activities that would remove or suppress populations. The aesthetics of a natural environment would continue to be diminished if invasive species allowed to expand and population

		and population allowed to increase.	allowed to increase.
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APPENDIX B AUTHORITY AND COMPLIANCE

Authority of U.S. and Puerto Rico Agencies

Several federal laws, Commonwealth laws, and Commonwealth regulations regulate the management of damage associated with monkeys in Puerto Rico. WS, the DNER, the PRDA, and the USFWS comply with these laws and regulations, and consults with other agencies as appropriate.

WS' Legislative Authorities

The primary statutory authority for the WS program is the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c). The WS program is the lead federal authority in managing damage to agricultural resources, natural resources, property, and threats to human safety associated with wildlife. WS' directives define program objectives and guide WS' activities to manage wildlife damage management.

U.S. Fish and Wildlife Service

The USFWS is the primary federal agency responsible for conserving, protecting, and enhancing the nation's fish and wildlife resources and their habitats. The USFWS mission is to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. Responsibilities are shared with other federal, state, tribal, and local entities; however, the USFWS has specific responsibilities for the protection of T&E species under the ESA, migratory birds, inter-jurisdictional fish, and certain marine mammals, as well as for lands and waters that the USFWS administers for the management and protection of those resources. The USFWS also manages lands under the National Wildlife Refuge System.

U.S. Environmental Protection Agency

The EPA is responsible for implementing and enforcing the FIFRA which regulates the registration and use of pesticides.

Commonwealth of Puerto Rico Department of Environmental and Natural Resources

The authority of the DNER to manage wildlife resources in Puerto Rico arises from the Constitution of the Commonwealth of Puerto Rico, Article VI, Section 19 and further defined under Law No. 241. The DNER, as the management authority for invasive monkey populations in Puerto Rico, will determine the final disposition of all monkeys live-captured by WS. WS' and other cooperating agencies will coordinate all activities with the DNER with all live-captured monkeys placed into the care of the DNER and/or PRDA. The fate of live-captured monkeys will be the sole responsibility of the DNER and/or the PRDA.

Puerto Rico Department of Agriculture

The PRDA promotes agricultural producers in Puerto Rico and provides the necessary support to ensure the development of a dynamic agricultural base that responds to the present and future needs of the people of Puerto Rico. Pesticide use and registrations is regulated by the PRDA, Agrologic Lab.

Compliance with U.S. and Puerto Rican Laws and Regulations

National Environmental Policy Act

NEPA was signed into law on January 1, 1970. NEPA requires federal agencies to incorporate environmental planning into federal agency actions and decision-making processes. The two primary objectives of NEPA are: 1) agencies must have available and fully consider detailed information regarding environmental effects of federal actions and 2) agencies must make information regarding environmental effects available to interested persons and agencies before decisions are made and before actions are taken.

NEPA provides a systemic process to determine the class of action necessary when potential environmental effects are identified. Generally, there are 3 classes of action: 1) Categorical Exclusions, 2) Environmental Assessments, and 3) Environmental Impact Statements.

This EA will assist WS and cooperating agencies in determining whether potential environmental impacts caused by a proposed action might be significant, requiring the preparation of an EIS. The development of this EA documents the incorporation of environmental planning into the actions and decision-making process to ensure compliance with NEPA requirement for the proposed action in the Commonwealth of Puerto Rico. When WS' direct management assistance is requested by another federal agency, NEPA compliance is the responsibility of the other federal agency. However, WS could agree to complete NEPA documentation at the request of the other federal agency.

Endangered Species Act

It is federal policy, under the ESA, that all federal agencies “...shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act” [Sec. 7(a)(1)]. WS conducts Section 7 consultations with the USFWS to ensure compliance with the ESA and to ensure that “any action authorized, funded or carried out by such an agency...is not likely to jeopardize the continued existence of any endangered or threatened species...Each agency shall use the best scientific and commercial data available” [Sec. 7(a)(2)].

WS has conducted a formal consultation with the USFWS on programmatic activities and received a BO describing potential effects on T&E species and prescribes reasonable and prudent measures for avoiding jeopardy (USDA 1997). WS has re-initiated formal consultation with the USFWS on programmatic activities to address threatened and endangered species proposed and listed since the BO was completed in 1992 and to address new methods available for managing damage and threats to human safety from wildlife. As part of the development of this EA, WS initiated informal consultation with the USFWS. Based on the review of T&E species in Puerto Rico, the methods available for use to manage invasive monkeys in Puerto Rico, and the scope of damage management activities, WS and cooperating agencies determined that when activities are conducted pursuant to this EA, those activities are not likely to adversely affect any T&E species in Puerto Rico. The USFWS concurred with the determination that activities are not likely to adversely impact species designated as T&E in Puerto Rico.

Commonwealth of Puerto Rico Law No. 241 (Approved August 15, 1999)

Puerto Rico Law No. 241, also known as, the New Wildlife Act of Puerto Rico, defines the protection of wildlife in the Commonwealth and places regulatory control of managing those resources to the DNER. The New Wildlife Act states:

“To establish the New Wildlife Act of Puerto Rico for the purpose of protecting, conserving and fostering native and migratory wildlife species; to declare as property of Puerto Rico all wildlife species within its jurisdiction; to define the faculties, powers and duties of the Secretary of the Department of Natural and Environmental Resources; to regulate hunting and the use of hunting weapons and their registration; to issue, renew and revoke hunting licenses, permits for operating game reserves and permits for hunting or collecting game for scientific, educational, recovery and population control purposes; to establish regulations for the introduction of exotic species into Puerto Rico; to fix penalties for violations of the provisions of this Act and of the regulations promulgated by virtue thereof and to repeal Act No. 70 of May 30, 1976, as amended.”

Commonwealth of Puerto Rico Regulation 7399

Regulation 7399 designates rhesus monkeys, patas monkeys, and the squirrel monkey as species hurtful to agricultural interests and that pose a threat to human safety in Puerto Rico. The regulation further prohibits the introduction, importation, possession, acquisition, sale, or transfer of monkeys in Puerto Rico. However, the regulation does not apply to government agencies or other public or private entities which are required to have monkeys to perform their activities when the appropriate written authorization is provided by the Secretary of the PRDA.

Commonwealth of Puerto Rico Regulation 6765

Regulation 6765 further defines exotic and invasive species in the Commonwealth of Puerto Rico and further designates monkeys in Puerto Rico as invasive species by the DNER. The DNER under the New Wildlife Act (Law 241) and under Regulation 6765 is designated the regulatory authority over wildlife species, including invasive species. Regulation 6765 defines the authority of the DNER to authorize take of invasive species through permits.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES is an international agreement to which States (countries) adhere voluntarily. States that have agreed to be bound by the Convention are known as Parties. Although CITES is legally binding on the Parties, in other words they have to implement the Convention, it does not take the place of national laws. CITES provides a framework to be respected by each Party, which has to adopt its own domestic legislation to make sure that CITES is implemented at the national level.

Species are listed by the Parties under three categories that offer different levels of protection through regulation of trade of specimens. Parties of CITES regulate the trade of dead and living specimens of species listed in the categories through the issuance of permits. Permits allow Parties to regulate the trade of species listed as endangered or could be endangered if unregulated trade was allowed. In the U.S., the USFWS is responsible for implementing and enforcing CITES.

The management of invasive monkeys in the Commonwealth of Puerto Rico is the responsibility of the DNER with CITES only applying to the import or export of monkeys into or from the Commonwealth.

Federal Insecticide, Fungicide, and Rodenticide Act

FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing FIFRA. The Commonwealth of Puerto Rico regulates pesticides through the PRDA, Agrologic Lab.

Investigational New Animal Drug

The FDA grants permission to use investigational new animal drugs (21 CFR 511). The sedative drug alpha-chloralose is registered with the FDA to capture waterfowl, coots, and pigeons. The use of alpha-chloralose by WS was authorized by the FDA through approval under the INAD which allows use of the drug as a non-lethal form of capture. Alpha-chloralose as a method for resolving monkey damage and threats to human safety is discussed in Appendix D of this EA.

Animal Welfare Act

The AWA requires that minimum standards of care and treatment be provided for certain animals bred for commercial sale, used in research, transported commercially, or exhibited to the public. Individuals who operate facilities in these categories must provide their animals with adequate care and treatment in the areas of housing, handling, sanitation, nutrition, water, veterinary care, and protection from extreme weather and temperatures. AC administers the AWA, its standards, and its regulations. The handling and transportation of monkeys for damage management purposes are not subject to the AWA.

National Historic Preservation Act (NHPA) of 1966, as Amended

The NHPA of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute “undertakings” that have the potential to cause effects on historic properties and, 2) if so, to evaluate the effects of such undertakings on historic resources and consult with the Advisory Council on Historic Preservation, as appropriate. Actions on tribal lands are only conducted at the tribe’s request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties.

Each method described in this EA that might be used operationally by WS and cooperating agencies does not cause major ground disturbance, does not cause any physical destruction or damage to property, does not cause any alterations of property, wildlife habitat, or landscapes, and does not involve the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used by WS and cooperating agencies under the proposed action are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

There is potential for audible effects on the use and enjoyment of a historic property when methods such as firearms are used at or in close proximity to such sites for purposes of removing animals. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve a damage or nuisance problem, which means such use would be to benefit the historic property. A built-in mitigating factor for this issue is that virtually all of the methods involved would only have temporary effects on the audible nature of a site and can be ended at any time to restore the audible qualities of such sites to their original condition with no further adverse

effects. Site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary in those types of situations.

Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act require federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal projects would discontinue work until a reasonable effort had been made to protect the items and the proper authority had been notified.

Invasive Species (Executive Order 13112)

Executive Order (EO) 13112 establishes guidance to federal agencies to prevent the introduction of invasive species, provide for the control of invasive species, and to minimize the economic, ecological, and human health impacts that invasive species cause. The Order states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law: 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations and provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education of invasive species.

Environmental Justice in Minority and Low-Income Populations (EO 12898)

Executive Order 12898, promotes the fair treatment of people of all races, income levels and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies, and activities on minority and low-income persons or populations. All activities are evaluated for their impact on the human environment and compliance with Executive Order 12898.

WS and cooperating agencies use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. All chemicals used by WS and cooperating agencies are regulated by the EPA through FIFRA, PRDA, FDA, DEA, by MOUs with land managing agencies, and by WS' Directives. Based on a thorough Risk Assessment, APHIS concluded that when WS' program chemicals are used according to label directions, they are selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997). WS and cooperating agencies will properly dispose of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. In contrast, the proposed action may benefit minority or low-income populations by reducing threats to public health and safety and property damage.

Protection of Children from Environmental Health and Safety Risks (EO 13045)

Children may suffer disproportionately for many reasons from environmental health and safety risks, including the development of their physical and mental status. WS and cooperating agencies makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. WS and cooperating agencies have considered the impacts that this proposal might have

on children. The proposed activities would occur by using only legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS and cooperating agencies conclude that it would not create an environmental health or safety risk to children from implementing this proposed action. Additionally, since the proposed monkey damage management program is directed at reducing human health and safety risks at locations where children are sometimes present, it is expected that health and safety risks to children would be reduced.

Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360)

This law places administration of pharmaceutical drugs, including those used in wildlife capture and handling, under the FDA.

Controlled Substances Act of 1970 (21 U.S.C. 821 et seq.)

This law requires an individual or agency to have a special registration number from the DEA to possess controlled substances, including those that are used in wildlife capture and handling.

Animal Medicinal Drug Use Clarification Act of 1994

The Animal Medicinal Drug Use Clarification Act of 1994 and its implementing regulations (21 CFR 530) establish several requirements for the use of animal drugs, including those used to capture and handle wildlife. Those requirements are: (1) a valid “veterinarian-client-patient” relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under the proposed action. WS and cooperating agencies establish procedures for administering drugs used in wildlife capture and handling that must be approved by veterinary authorities in order to comply with this law.

Occupational Safety and Health Act of 1970

The Occupational Safety and Health Act of 1970 and its implementing regulations (29 CFR 1910) on sanitation standards states that, “Every enclosed workplace shall be so constructed, equipped, and maintained, so far as reasonably practical, as to prevent the entrance or harborage of rodents, insects, and other vermin. A continuing and effective extermination program shall be instituted where their presence is detected.” This standard includes mammals that may cause safety and health concerns at workplaces.

**APPENDIX C
THREATENED AND ENDANGERED SPECIES IN THE COMMONWEALTH OF PUERTO
RICO**

The following species are listed by the USFWS as endangered or threatened in the Commonwealth of Puerto Rico:

E=Endangered T=Threatened

<i>Status</i>	<i>Species listed in this state and that occur in this state</i>
E	Anole, Culebra Island giant (<i>Anolis roosevelti</i>)
E	Blackbird, yellow-shouldered (<i>Agelaius xanthomus</i>)
T	Boa, Mona (<i>Epicrates monensis monensis</i>)
E	Boa, Puerto Rican (<i>Epicrates inornatus</i>)
E	Boa, Virgin Islands tree (<i>Epicrates monensis granti</i>)
T	Coqui, golden (<i>Eleutherodactylus jasperī</i>)
T	Coral, elkhorn (<i>Acropora palmata</i>)
T	Coral, staghorn (<i>Acropora cervicornis</i>)
E	Gecko, Monito (<i>Sphaerodactylus micropithecus</i>)
T	Guajon (<i>Eleutherodactylus cooki</i>)
E	Hawk, Puerto Rican broad-winged (<i>Buteo platypterus brunnescens</i>)
E	Hawk, Puerto Rican sharp-shinned (<i>Accipiter striatus venator</i>)
T	Iguana, Mona ground (<i>Cyclura cornuta stejnegeri</i>)
E	Manatee, West Indian (<i>Trichechus manatus</i>)
E	Nightjar, Puerto Rican (<i>Caprimulgus noctitherus</i>)
E	Parrot, Puerto Rican (<i>Amazona vittata</i>)
E	Pelican, brown except U.S. Atlantic coast, FL, AL (<i>Pelecanus occidentalis</i>)
E	Pigeon, Puerto Rican plain (<i>Columba inornata wetmorei</i>)
T	Plover, piping except Great Lakes watershed (<i>Charadrius melodus</i>)
T	Sea turtle, green except where endangered (<i>Chelonia mydas</i>)
E	Sea turtle, hawksbill (<i>Eretmochelys imbricata</i>)
E	Sea turtle, leatherback (<i>Dermochelys coriacea</i>)

- T Sea turtle, loggerhead (*Caretta caretta*)
- E Seal, Caribbean monk (*Monachus tropicalis*)
- T Tern, roseate Western Hemisphere except NE U.S. (*Sterna dougallii dougallii*)
- T Toad, Puerto Rican crested (*Peltophryne lemur*)
- E Whale, finback (*Balaenoptera physalus*)
- E Whale, sperm (*Physeter catodon (=macrocephalus)*)

Status **Species listed in this state that do not occur in this state**

- E Crow, white-necked (*Corvus leucognaphalus*)

Plants -- 49 listings

Status **Species listed in this state and that occur in this state**

- E Bariaco (*Trichilia triacantha*)
- E Boxwood, Vahl's (*Buxus vahlia*)
- E Capa rosa (*Callicarpa ampla*)
- T Chumbo, Higo (*Harrisia portoricensis*)
- E Chupacallos (*Pleodendron macranthum*)
- T Cobana negra (*Stahlia monosperma*)
- E Erubia (*Solanum drymophilum*)
- E Fern, Elfin tree (*Cyathea dryopteroides*)
- E Goetzea, beautiful (*Goetzea elegans*)
- E Higuero de sierra (*Crescentia portoricensis*)
- E Holly, Cook's (*Ilex cookii*)
- T Manaca, palma de (*Calyptronoma rivalis*)
- E *Adiantum vivesii* (No common name)
- E *Aristida chaseae* (No common name)
- E *Auerodendron pauciflorum* (No common name)
- E *Calyptranthes thomasiana* (No common name)

- E ***Catesbaea melanocarpa*** (No common name)
- E ***Chamaecrista glandulosa var. mirabilis*** (No common name)
- E ***Cordia bellonis*** (No common name)
- E ***Cranichis ricartii*** (No common name)
- E ***Daphnopsis hellerana*** (No common name)
- E ***Elaphoglossum serpens*** (No common name)
- E ***Eugenia woodburyana*** (No common name)
- T ***Gesneria pauciflora*** (No common name)
- E ***Ilex sintenisii*** (No common name)
- E ***Lepanthes eltoroensis*** (No common name)
- E ***Leptocereus grantianus*** (No common name)
- E ***Lyonia truncata var. proctorii*** (No common name)
- E ***Mitracarpus maxwelliae*** (No common name)
- E ***Mitracarpus polycladus*** (No common name)
- E ***Myrcia paganii*** (No common name)
- E ***Polystichum calderonense*** (No common name)
- T ***Schoepfia arenaria*** (No common name)
- E ***Tectaria estremerana*** (No common name)
- E ***Ternstroemia subsessilis*** (No common name)
- E ***Thelypteris inabonensis*** (No common name)
- E ***Thelypteris verecunda*** (No common name)
- E ***Thelypteris yaucoensis*** (No common name)
- E ***Vernonia proctorii*** (No common name)
- E Palo colorado (***Ternstroemia luquillensis***)
- E Palo de jazmin (***Styrax portoricensis***)
- E Palo de nigua (***Cornutia obovata***)
- E Palo de ramon (***Banara vanderbiltii***)
- E Palo de rosa (***Ottoschulzia rhodoxylon***)

- E Pelos del diablo (*Aristida portoricensis*)
- E Peperomia, Wheeler's (*Peperomia wheeleri*)
- E Prickly-ash, St. Thomas (*Zanthoxylum thomasianum*)
- E Uvillo (*Eugenia haematocarpa*)
- E Walnut (=Nogal), West Indian (*Juglans jamaicensis*)

The following species are listed by the DNER as Vulnerable or Threatened and Endangered in the Commonwealth of Puerto Rico:

Species in Danger of Extinction (EPE) - Species of vulnerable species in danger of extinction whose population numbers are such that in opinion of the Secretary require special attention to ensure their perpetuation in the physical space where they exist and are designated species in Danger or Critical Danger.

Species Vulnerable (VU) - Species that although are not in critical danger or danger, or facing a high risk of extinction in their wild state in the immediate future.

In Danger (EN) - Species that although are not in critical danger, face a high risk of extinction in the wild state in the near future.

In Critical Danger (PC) - Species that are in an extremely high risk of extinction in the immediate future.

Deficient in Data (DD) – There is a lack of scientific data on a particular species.

Uncommon (U) – Species is uncommon throughout its range.

Limited Range (LR) – Species distribution is naturally limited due to environmental requirements.

- U *Megaptera novaengliae* (Humpback whale)
- EN *Trichechus manatus* (West Indian Manatee)
- DD *Monophyllus redmani* (Greater antillean long tongued bat)
- VU *Stenoderma rufum* (Red fruit bat)
- VU *Erophylla sezekorni* (Brown flower bat)
- DD *Brachyphylla cavernarum* (Cave bat)
- DD *Noctilio leporinus* (No Common Name)
- LR *Tadarida brasiliensis* (Brazilian free-tailed bat)
- DD *Tachybaptus dominicus* (Least Grebe)
- EN *Pelecanus occidentalis* (Brown pelican)
- EN *Nomonyx dominica* (Masked duck)
- VU *Oxyura jamaicensis* (Ruddy duck)
- PC *Dendrocygna arborea* (West Indian Whistling Duck)
- VU *Anas bahamensis* (White Cheeked Pintail)
- CR *Accipiter striatus venator* (Shinned Hawk)
- CR *Buteo platypterus brunnescens* (Broad Winged Hawk)
- DD *Porzana flaviventer* (Yellow-breasted crane)

VU	<i>Fulica caribaea</i> (Caribbean coot)
CR	<i>Charadrius alexandrinus</i> (Snowy plover)
CR	<i>Charadrius melodus</i> (Piping plover)
DD	<i>Sterna antillarum</i> (Least tern)
VU	<i>Sterna dougalli</i> (Roseate tern)
CR	<i>Falco peregrinus tundrius</i> (Peregrine falcon)
EN	<i>Columba inornata wetmorei</i> (Plain pigeon)
DD	<i>Columba leucocephala</i> (White-crowned pigeon)
DD	<i>Geotrygon chrysia</i> (Key west quail-dove)
DD	<i>Geotrygon mystacea</i> (Bridled quail dove)
CR	<i>Amazona vittata vittata</i> (Puerto Rican parrot)
EN	<i>Agelaius xanthomus</i> (Yellow-shouldered blackbird)
DD	<i>Icterus dominicensis</i> (Black cowled oriole)
DD	<i>Ammodramus savannarum</i> (Grasshoper sparrow)
VU	<i>Dendroica angelae</i> (Elfin woods warbler)
LR	<i>Vireo latimeri</i> (Puerto Rican Vireo/ Latimer's Vireo)
DD	<i>Carduelis cucullata</i> (Red Siskin)
EN	<i>Caprimulgus noctiterus</i> (Puerto Rican Nightjar/Puerto Rican Whip Poor Will)
VU	<i>Epicrates inornatus</i> (Puerto Rican Boa)
CR	<i>Epicrates monensis granti</i> (Boa Pinta)
EN	<i>Epicrates monensis monensis</i> (Mona's Boa)
DD	<i>Typhlops monensis</i> (None)
DD	<i>Typhlops granti</i> (None)
DD	<i>Sphaerodactylus levinsi</i> (Desecheo's gecko)
DD	<i>Sphaerodactylus gaigae</i> (Pandura's gecko)
CR	<i>Sphaerodactylus micropithecus</i> (Monito's gecko)
VU	<i>Mabuya mabouya sloanei</i> (Slipperyback skink)
VU	<i>Anolis poncensis</i> (None)
EN	<i>Anolis cooki</i> (None)
CR	<i>Anolis roosevelti</i> (None)
EN	<i>Cyclura cornuta stejnegeri</i> (Mona Island Iguana)
EN	<i>Chelonia mydas</i> (Green Sea Turtle)
EN	<i>Eretmochelys imbricata</i> (Hawksbill Turtle)
EN	<i>Dermochelys coriacea</i> (Leather back turtle)
DD	<i>Trachemys stejnegeri</i> (Puerto Rican Slider)
VU	<i>Eleutherodactylus cooki</i> (Cave frog/ Rock frog)
CR	<i>Eleutherodactylus jasperii</i> (Golden Coqui Frog)
CR	<i>Eleutherodactylus eneidae</i> (Mottled Coqui)
CR	<i>Eleutherodactylus karlschmidti</i> (Webbed footed Coqui/ Tree hole coqui)
DD	<i>Eleutherodactylus hedricki</i> (Hendrick's Coquí)
VU	<i>Eleutherodactylus locustus</i> (Locust Coqui/ Warty Coqui)
VU	<i>Eleutherodactylus richmondi</i> (Richmond's Coqui/ Ground Coqui)
VU	<i>Eleutherodactylus portoricensis</i> (Puertorican Mountain Coqui/ Forest Coqui)
CR/EN	<i>Peltophryne lemur</i> (Puerto Rican Crested Toad)
EN	<i>Epinephelus striatus</i> (Nassau grouper)
CR	<i>Epinephelus itajitara</i> (Jewfish)
CR	<i>Joturus pichardi</i> (Hognose mullet)
VU	<i>Hippocampus spp.</i> (Sea horses)
CR	<i>Atlantea tulita</i> (None)
LR	<i>Uca major</i> (None)

DD	<i>Uca thayeri</i> (None)
DD	<i>Uca vocator</i> (None)
LR	<i>Goniopsis cruentata</i> (None)
DD	<i>Aratus pisonii</i> (None)
LR	<i>Macrobrachium carcinus</i> (None)
DD	<i>Macrobrachium faustinum</i> (None)
LR	<i>Macrobrachium crenulatum</i> (None)
DD	<i>Macrobrachium acanthurus</i> (None)
DD	<i>Macrobrachium heterochirus</i> (None)
CR	<i>Typhlatya monae</i> (None)
LR	<i>Epilobocera suinatifrons</i> (None)
LR	<i>Gecarcinus ruricola</i> (None)
DD	<i>Gecarcinus lateralis</i> (None)
LR	<i>Cardisoma guanhumi</i> (None)
LR	<i>Ucides cordatus</i> (None)
VU	<i>Panulirus laevicauda</i> (None)
CR	<i>Alloweckellia gurnee</i> (None)
CR	<i>Ilex cookii</i> (Cook's Holly)
EN	<i>Ilex sintenisii</i> (None)
EN	<i>Calyptrionoma rivalis</i> (Puerto Rican Manac)
CR	<i>Vernonia proctorii</i> (None)
CR	<i>Crescentia portoricensis</i> (None)
EN	<i>Cordia bellonis</i> (Puerto Rico Manjack)
EN	<i>Buxus vahlii</i> (Vahl's Boxwood)
VU	<i>Harrisia portoricensis</i> (Higo Chumbo)
CR	<i>Leptocereus grantianus</i> (None)
CR	<i>Pleodendron macranthum</i> (None)
EN	<i>Cyathea dryopteroides</i> (None)
CR	<i>Lyonia truncata</i> var. <i>Proctorii</i> (None)
EN	<i>Chamaecrista glandulosa</i> variedad <i>mirabilis</i> (Puerto Rico Senna)
VU	<i>Stahlia monosperma</i> (None)
CR	<i>Banara vanderbiltii</i> (None)
VU	<i>Gesneria pauciflora</i> (None)
CR	<i>Ottoschulzia rhodoxylon</i> (None)
CR	<i>Juglans jamaicensis</i> (West Indian Walnut)
CR	<i>Trichilia triacantha</i> (None)
CR	<i>Calyptranthes thomasiana</i> (Thoma's Lidflower)
EN	<i>Eugenia haematocarpa</i> (None)
CR	<i>Eugenia woodburyana</i> (None)
CR	<i>Myrcia paganii</i> (None)
EN	<i>Schoepfia arenaria</i> (Arana)
CR	<i>Cranichis ricartii</i> (Orquidea)
CR	<i>Lepanthes eltoroensis</i> (None)
EN	<i>Peperomia wheeleri</i> (None)
EN	<i>Aristida chaseae</i> (None)
CR	<i>Aristida portoricensis</i> (None)
CR	<i>Adiantum vivesii</i> (None)
CR	<i>Elaphoglossum serpens</i> (CR)
CR	<i>Polystichum calderonense</i> (None)
CR	<i>Tectaria estremerana</i> (None)

CR	<i>Thelypteris inabonensis</i> (None)
CR	<i>Thelypteris verecunda</i> (None)
CR	<i>Thelypteris yaucoensis</i> (None)
CR	<i>Aurodendron pauciflorum</i> (None)
EN	<i>Mitracarpus maxwelliae</i> (None)
EN	<i>Mitracarpus polycladus</i> (None)
EN	<i>Zanthoxylum thomasianum</i> (St. Thomas prickly-ash)
CR	<i>Styrax portoricensis</i> (None)
EN	<i>Goetzea elegans</i> (None)
EN	<i>Solanum dryophilum</i> (None)
CR	<i>Ternstroemia luquillensis</i> (None)
CR	<i>Ternstroemia subsessilis</i> (None)
CR	<i>Daphnopsis helleriana</i> (None)
CR	<i>Callicarpa ampla</i> (None)
CR	<i>Cornutia obovata</i> (None)

APPENDIX D
METHODS AVAILABLE FOR USE OR RECOMMENDED TO MANAGE PATAS AND
RHESUS MONKEY DAMAGE OR THREATS TO HUMAN SAFETY IN THE
COMMONWEALTH OF PUERTO RICO

INTRODUCTION

Trapping is the most common technique for capturing primates. Traps can range from home-made cage traps to the professional Tomahawk live trap. The key to live trapping is location and pre-baiting; however, live-capturing primates can often be expensive and laborious to conduct. Difficulty in live-capture is often dependant on species, topography, climate, season, food availability, and other factors. It has also been suggested that the use of a decoy might be advantageous in primate trapping. Decoys can also be used to dart or net the targeted primate. Live trapping of vervet populations in Barbados has shown a population shift towards younger age classes and an increase in agriculture damage complaints. This would indicate that adults were more susceptible to trapping than younger age classes and that the younger age classes are more serious agriculture pests than adults (Horrocks and Baulu 1988).

Evans (1989) pre-baited and habituated monkeys to food in cage traps during trapping efforts to capture rhesus monkeys on Desecheo Island. Members of the troop that were not captured initially became wary and trap-shy. Before control efforts on the island, Evans (1989) found that the average flight distance of the monkeys was 30 + meters when disturbed. Later, after control efforts were underway, flight distance was much greater. Once the monkeys developed an aversion to the traps, trapping was replaced by shooting. González-Martínez (1995) used cage traps to capture monkeys in southwest Puerto Rico for radio collaring.

Darting is a technique often used to capture individuals or small numbers of primates. It is not a device practical to capture large numbers of animals at any one time. Darting devices may include blowguns and dartguns. Effectiveness of using this method is dependant on vegetation density, canopy height, topography, and species. Darting is also more prone to injuring an animal by falls, blunt-force trauma of the dart hitting the animal, and overdosing. On Desecheo Island, Evans (1989) found that tranquilizer guns where not effective because of sight distance. Welfare of monkeys once tranquilized was of concern, plus traumatic injuries were a concern such as broken bones and punctured abdomens. It was concluded that darting was not practical on the island (Evans 1989). However, darting may be more effective when monkeys are confined inside a large live-capture trap where sight distance is not a factor nor is injury from falling a concern. Concern would still arise from the potential for injury from the force of the dart impacting the monkey. Using a blowgun could alleviate some of the concerns relating to blunt force trauma from the dart impact. Blow darts use less force but require more skill and practice.

Nets have been used to effectively capture both small and large primates. Uses of netting material could vary from barrier type devices, drop nets, cannon nets, or mist nets. The type of net used depends on species, habitat, application, and the vulnerability of animals. Set-up of capture nets can be very labor intensive and could cause injury to both the personnel and/or monkeys (Eisenberg 1981).

Several researchers have suggested various methods of reducing crop damage caused by monkeys. Some of the suggested methods include the use of electric fencing, dogs, and live-trapping of problem animals and juveniles. It has also been suggested that only a small proportion of a population can be live-trapped, thus, making complete removal of monkeys using this method impossible (Sade and Haldebrech 1965, Morrison and Menzel 1972, Poirier 1972, McGuire 1974, Horrocks 1986, Horrocks and Baulu 1988, Evans 1989, Lippold 1989, González-Martínez 1996). González-Martínez (1996) suggested that monkey densities could be controlled by sterilization and the removal of young breeding females from each group.

Theoretically, sterilization would work if all females were effectively sterilized, but this seldom, if ever, is likely to happen in nature. Effectively, sterilization would shift the age structure of the groups.

St. Kitts' farmers have used scarecrows, dogs, hunters, trappers, and harassment to discourage crop-raiding monkeys for years, but none of this has stopped the green monkey from raiding crops (Poirier 1972). Similar responses to herdsman and farmers were observed with patas monkeys in Tenzugu, Kenya (Chism and Rowell 1988). Shooting is a method used by farmers to discourage crop-raiding monkeys as permitted by the DNER.

Methods currently available for use by the interagency team to manage damage and threats associated with monkeys in Puerto Rico include the following:

Habitat Management

Localized habitat management is an integral part of an integrated approach to managing damage. The type, quality, and quantity of habitat are directly related to the wildlife produced or attracted to an area. Habitat can be managed to not produce or attract certain wildlife species. Limitations of habitat management as a method of reducing wildlife damage are determined by the characteristics of the species involved, the nature of the damage, economic feasibility, and other factors. Legal constraints may also exist which preclude altering particular habitats. Removal or thinning of the brush can discourage some monkey activity. Also, opening the area allows for better monitoring of the area and also increases the value of shooting.

Though habitat management could be recommended or used by the interagency team, any modification to habitat would be localized and would not involve modification of habitat over a large area. Habitat modification may include removal of trees or vegetation that may be attracting monkeys to the area, such as fruit trees or other natural food sources. The interagency team may recommend that a requester clear brush from specific areas to reduce the availability of cover for monkeys. Habitat management would be available for use under any of the alternatives discussed previously.

Modification of Human Behavior

The interagency team often tries to alter human behavior to resolve potential conflicts between humans and wildlife. Many wildlife species adapt well to human settlements and activities, but their proximity to humans may result in damage or threats to public health and safety. Another example of human behavior modification is just assisting people that have a fear of an animal. WS and cooperating agencies provide educational information and reassurance about these species. The modification of human behavior would be available under all the alternatives discussed in detail.

Physical Exclusion

Physical exclusion methods restrict the access of wildlife to resources. These methods can provide effective prevention of wildlife damage in many situations.

Exclusionary fences can be effective in keeping species from some resources, however, the design of the enclosure and height of the fence must be able to keep the target species out. Electric fences must be maintained and tested regularly. Vegetation and fallen branches on the fence drain current, thus reducing efficacy. Also, dry soil conditions prevent grounding, and thus the animal can pass through the fence without being shocked. Temporary fencing is placing temporary electric polytape fence to deter target

species for a day to a week or more to protect resources. Other exclusionary methods could be used such as different types of fencing or other barriers that prevent access to a valuable resource.

However, fencing and exclusionary devices do have limitations. Even an electrified fence is not always effective and the expense of the fencing can often exceed the benefit. In addition, if large areas are fenced, the monkeys being excluded have to be removed from the enclosed area to make it useful. Some fences inadvertently trap, catch, or affect the movement of non-target wildlife. Further, fencing is not practical or legal in some areas (*e.g.*, areas near people). Exclusion devices would be available under all the alternatives discussed in detail.

Cultural Methods

Cultural methods include the application of practices which seek to minimize exposure of the protected resource to damaging animals through processes other than exclusion. They may include animal husbandry practices such as employing guard dogs or planting less susceptible crops. Strategies may also include minimizing cover where damaging wildlife might hide, manipulating the surrounding environment through barriers to deter animals from entering a protected area, or planting lure crops on fringes of protected crops.

Some monkeys which cause damage in urban environments are attracted to homes by the presence of garbage, pet food, or other food items left outside and unprotected. By removing potential food sources, monkeys can be discouraged from the area. Cultural methods would be available under all the alternatives discussed.

Frightening Devices

Frightening devices are used to repel wildlife from an area where there is a damage risk. The success of frightening methods (*i.e.*, propane exploders, pyrotechnics, lights, electronic guard, rubber bullets, and bean bags) depends on an animal's fear of, and subsequent aversion to, offensive stimuli. A persistent effort by the person applying the techniques is usually required to effectively apply frightening techniques and the techniques must be sufficiently varied to prolong their effectiveness. Over time, animals often habituate to scare tactics and ignore them (Pfeifer and Goos 1982, Conover 1982, Shivik and Martin 2001). In addition, animals frightened from one location can become a problem at another. Scaring devices are directed at specific target species; however, several of these devices, such as propane exploders can be automated. Frightening devices are used to frighten predators from the immediate vicinity of the damage prone area. As with other damage management efforts, these techniques tend to be more effective when used collectively in a varied regime rather than individually. However, the continued success of these methods frequently requires reinforcement by limited shooting (see shooting below). Frightening devices would only be used in limited situations where other methods were ineffective or where other methods were deemed inappropriate. When considering the use of frightening devices, consideration would also be given to the potential for frightening methods to disperse monkeys. In those situations where dispersal may occur from repeated use of frightening devices, those methods would not be deployed. Most frightening techniques would be available under all of the discussed alternatives.

Shooting

Shooting is selective for target species since targets are identified before application. Shooting is an effective method to remove a small number of monkeys where damage is occurring. Shooting is often used opportunistically where target individuals are observed in an area where damage is occurring. The discharge of firearms is limited to locations where it is legal and safe. Shooting can be expensive because it often requires many staff hours to obtain adequate removal of target species to alleviate damage or reduce threats. Since the discharge of firearms often acts as a harassment or dispersal technique to target species in the immediate area of application, a concern arises from the potential for monkeys to disperse to other areas when shooting is used as a method. To alleviate concerns of dispersing monkeys from the use of shooting, the use of firearms would be limited to those situations where other methods have been ineffective, where the availability of other methods are limited, or in situations where resolution of the damage or threat is required immediately.

When considering the use of firearms to resolve damage or threats associated with monkeys through the decision-making process of the respective agencies, consideration will also be given to the potential for the use of firearms to disperse monkeys from the area where damage is occurring. This method would only be used in areas and at times which are deemed safe. Shooting could also occur in conjunction with night vision equipment, infrared devices, and spotlights where deemed appropriate. The use of shooting would be available under the proposed action and could be available to affected property owners or managers under Alternative 2 and Alternative 3 if permitted by the DNER.

Capture Methods

Several methods are available to capture or take target animals. The appropriateness and efficacy of any technique will depend on a variety of factors. Some of the more common methods are described below:

Foothold Traps – Foothold traps are versatile and widely used by wildlife damage management professionals for live-capturing and restraining a variety of animals. Traps are most often buried in shallow depressions with a thin layer of soil placed over the trap for concealment in areas where target species frequent. Attractants are often placed near the trap and consist of food-based baits or scents that trigger an investigative behavior in the target species. The triggering mechanism of a foothold trap consists of the pan. The pan is a flat metal circular piece in the center of the trap. When set the pan is elevated slightly above the base of the trap using the “dog” which lies over the jaws of the trap keeping the jaws open and compressing the springs. The pan and trap are then placed in the shallow depression in the ground and covered with soil. When the pan is depressed with sufficient weight the springs are released and the jaws of the trap are closed. When closed, the jaws restrain the animal usually around the foot since depression of the pan usually occurs by force applied by the foot. Traps are often staked to the ground to limit the movement of the animal once captured. Advantages of the foothold trap are: 1) they can be set under a wide variety of conditions; 2) captured wildlife are live-captured; 3) non-targets captured can be released; and 4) pan-tension devices can be used to reduce the probability of capturing smaller non-target animals (Turkowski et al. 1984, Phillips et al. 1996). Placement of these traps is contingent upon the habits of the respective target species, habitat conditions, and presence of non-target animals. Effective trap placement and the use of appropriate baits and lures contribute to the selectivity of the foothold trap.

Disadvantages of using foothold traps include the difficulty of keeping them in operation during rainy weather, and they lack selectivity where non-target species are of a similar or heavier weight as the target species. The use of foothold traps also requires more time and labor than some methods. Opposition to the use of foothold traps has increased in recent years due to public concern that the foothold trap inflicts unacceptable injuries to trapped animals. Foothold traps are constantly being modified and tested to improve animal welfare of captured animals. To minimize pain when using

steel-jawed foothold traps, only those traps with padded jaws will be used to capture monkeys in Puerto Rico. Padded jaws can reduce pain and minimize injury to the foot when wildlife are restrained. Research on the padded foothold traps, such as the No. 3 Victor Soft Catch foothold trap, has demonstrated that padded foothold traps can be used effectively to capture coyotes while producing only minor leg injuries (Phillips et al. 1996). Recent research comparing leg injuries associated with standard and modified Soft Catch foothold traps indicates that the addition of a “taos lightning” spring kit can further reduce injuries to captured animals and increase capture efficiency (Gruver et al. 1996). Soft Catch foothold traps modified with “taos lightning” springs kits may be used in some situations.

Only foothold traps appropriate to restraining monkeys will be used. All traps will be checked at least every 24-hours to ensure that animals live-captured will be addressed timely to minimize distress. Trap-monitoring devices may also be used to facilitate checking traps in a timely manner. Traps will only be placed in areas where monkeys are active. All non-targets captured will be released unless the survivability of the animal is questioned. Traps are most often set in rural areas in pastures or forested areas away from human activity areas. When appropriate, signs will be placed at access points to notify the public that traps are being used in the area. The use of traps will only be used when agreed upon by the property owner or manager which can further restrict access to the area where trapping is occurring.

Other foot restraining devices may also be employed by WS, including the use of enclosed foothold traps. Enclosed foothold traps are those where the trigger is enclosed inside the trap with the opening that allows access to the trigger being restricted to prevent non-targets from activating the trap. The trigger is pull-activated and recessed from the opening of the trap requiring the target animal to reach inside the trap and pull the trigger to activate. Bait or other attractant is placed inside the trap on or near the trigger mechanism. When the trigger mechanism is activated, the foot of the animal is restrained inside the trap which limits access of the animal to the restraining device and the foot area. Animals are live-captured using this device. Baits are hidden from view and access is limited to those animals that can reach inside the trap and grasp the trigger mechanism since the trigger must be pulled to activate the trap. The small diameter of the opening of the trap further restricts access to the trigger mechanism to only target animals. The design of the traps reduces the potential for capturing dogs, cats, and other non-target wildlife.

Foothold traps would be allowed for use by cooperating agencies under the proposed action. The use of foothold traps to capture monkeys could be available under Alternative 1 and Alternative 2 if permitted by the DNER.

Cage Traps – Cage traps come in a variety of styles to target different species. Traps are placed in areas where activity by the target species is high and are baited with an attractant. When the target animal enters the cage trap to investigate the attractant, a pan or wire is triggered releasing the door and enclosing the animal inside the cage trap. Traps can also be designed with a one way door so target animals enter into the trap to investigate an attractant but once inside, are unable to exit the trap. Traps can range in size from smaller cage traps to larger corral style traps. Large cage-type traps could work well for capturing monkeys provided the traps can be transported by vehicle and the individual target animals do not avoid cage traps. Some non-target animals become habituated to cage traps and purposely get captured to eat the bait, making the trap unavailable to catch target animals. These behaviors can make a cage trap less effective.

Cage traps will be checked at least every 24 hours to ensure animals captured are addressed in a timely manner to minimize distress. Trap monitoring devices may also be used to prioritize trap

checking, minimize the amount of time required to check traps, and to decrease the presence of humans in the area.

Under the proposed action, cage traps could be used where deemed appropriate by the decision-making process of the respective agencies. Cage traps would also be available under Alternative 2 and Alternative 3 but the capturing of monkeys would require a permit from the DNER.

Trap Monitors – Trap monitors are devices that send a radio signal to a receiver device if a set trap is disturbed and alert field personnel that an animal may be captured. Trap monitors can be attached directly to the trap or attached to a string or wire and then placed away from the trap in a tree or shrub. When the monitor is hung above the ground, it can be detected from several miles away, depending on the terrain in the area. There are many benefits to using trap monitors, such as saving considerable time when checking traps, decreasing fuel usage, prioritizing trap checks, and decreasing the need for human presence in the area. Trap monitors would be used under the proposed action where appropriate but are not likely to be used by under Alternative 2 and Alternative 3 due to the cost of purchasing the monitors to those using traps.

Drop-nets – Nylon or cloth nets are suspended above an area actively used by an animal or group of animals where target individuals have been conditioned to feed. The area is baited and once feeding occurs under the net, the net is released. Drop nets require constant supervision by personnel to drop the net when target individuals are present and underneath the net. This method has limited use due to the time and effort required to condition monkeys to feed in a location and the required monitoring of the site to drop the net when target wildlife are present. Nets are used to live-capture target individuals and if any non-targets are present, they can be released on site unharmed. Drops nets would be available under all the alternatives for use but under Alternative 2 and Alternative 3, those employing drop nets would be required to have a permit from the DNER to manage monkeys.

Cannon Nets – Similar to drop nets, cannon nets use a nylon or cloth net to capture wildlife that have been conditioned to feed in a given area through baiting. When using cannon nets, the net is fully deployed to determine the capture area when fired. Once the capture zone has been established the net is rolled up upon itself and bait is placed inside the zone to ensure feeding wildlife are captured. When target wildlife are feeding at the site and within the capture zone of the net, the launcher is activated by personnel near the site which launches the net over the target wildlife. The net is launched using small explosive charges and weights. Only personnel trained in the safe handling of explosive charges will be allowed to employ cannon nets when explosive charges are used. Pneumatic cannon nets can also be used which propels the net using air pressure instead of small explosive charges. Cannon nets require personnel to be present at the site continually to monitor for feeding. Non-targets incidentally captured can be released on site unharmed. Cannon nets would be available for use by cooperating agencies under the proposed action but would not be available under Alternative 1 or Alternative 2.

Tracking Collars

Tracking collars are often used as part of ecology studies to locate and track movements of individuals or groups. González-Martínez (1995) placed radio collars on live-captured monkeys in southwest Puerto Rico to locate and track the movements of monkey groups. The group structure of monkeys allows a single individual to be live-captured, fit with a tracking collar, and released to return back to the group.

Locating groups and tracking the movements of groups can aid in placing traps and employing damage management methods to allow for maximum effectiveness and to minimize non-target take.

Once an individual is live-captured, monkeys are fitted with a tracking collar that does not interfere with the daily activities of the monkeys or the status of the individual in the group. Collars emit a signal that can be located and monitored using telemetry or satellite equipment. The effectiveness of damage management activities can be enhanced once movement patterns can be established for target species. Knowing movement and activity patterns, allow damage management methods and techniques to be applied in localized areas to achieve maximum effectiveness and to minimize capturing non-targets. Tracking collars can also provide indication if monkeys are dispersing from the area once damage management activities are initiated. The use of tracking collars would only be available to cooperating agencies under the proposed action.

Tracking Dogs

Tracking dogs are sometimes trained and used to locate target species to aid in wildlife damage management (Rowley and Rowley 1987, Coolahan 1990). Training and maintaining suitable dogs requires considerable skill, effort, and expense. There must be sufficient need for dogs to make the effort of training worthwhile. The dogs become familiar with the scent of the target species they are to track and follow the scent. Tracking of the dogs occurs through their intermittent barks or howls but can also be tracked using radio collars. Tracking dogs are trained not to follow the scent of non-target species.

Dogs will be used in limited situations to locate groups of monkeys identified as responsible for causing damage or posing threats. By locating groups of monkeys or areas where monkeys frequent, appropriate damage management methods can be employed in those areas. Therefore, dogs will only be used to locate and track monkeys in remote areas. Consideration will be given to the potential for dogs to disperse monkeys from areas before employing tracking dogs. Tracking dogs would only be available under the proposed action.

Chemical Immobilizing and Euthanizing Drugs

Chemical immobilizing and euthanizing drugs are important tools for managing wildlife. All personnel involved with using immobilizing and euthanizing drugs will be properly trained in the use and handling of those drugs. For WS, all personnel involved with monkey damage management activities that use immobilizing or euthanizing drugs will be certified for their use and follow the guidelines established in the WS' Field Operational Manual for the Use of Immobilization and Euthanasia Drugs. Administering immobilizing drugs to live-captured monkeys will occur primarily through intramuscular injection of the drug once live-captured and restrained. González-Martínez (1995) used ketamine to immobilize monkeys live-captured in cage traps once the monkeys were restrained in squeeze-cages. Evans (1989) also used ketamine to immobilize live-captured monkeys on Desecheo Island. Immobilizing drugs may be administered through the use of pneumatic dart guns, blowgun, or jabsticks, in those situations where deemed appropriate. Immobilizing could occur through hand-baiting if found to be a safe and effective method for immobilizing monkeys based on future research. The use of immobilizing drugs as part of an adaptive management program will pose no threat to human safety given the controlled situation of application. Drugs will be delivered directly through injection to restrained monkeys. Storage, transportation, and handling of all immobilizing drugs will be in accordance to WS' directives, requirements of respective agencies, DEA requirements, FDA requirements, and Commonwealth laws and regulations. Immobilizing and euthanasia drugs would only be available to cooperating agencies under the proposed action and would not be available for use under Alternative 2 or Alternative 3.

The immobilizing agents available include:

Ketamine (Ketamine HCl) is a dissociative anesthetic that is used to capture wildlife, primarily mammals, birds, and reptiles. It is used to eliminate pain, calm fear, and allay anxiety. Ketamine is possibly the most versatile drug for chemical capture, and it has a wide safety margin (Fowler and Miller 1999). When used alone, this drug may produce muscle tension, resulting in shaking, staring, increased body heat, and, on occasion, seizures. Usually, ketamine is combined with other drugs such as xylazine. The combination of such drugs is used to control an animal, maximize the reduction of stress and pain, and increase human and animal safety. A DEA license is required to possess ketamine.

Telazol is a more powerful anesthetic and usually used for larger animals. Telazol is a combination of equal parts of tiletamine hydrochloride and zolazepam hydrochloride. The product is generally supplied sterile in vials, each containing 500 mg of active drug, and when dissolved in sterile water has a pH of 2.2 to 2.8. Telazol produces a state of unconsciousness in which protective reflexes, such as coughing and swallowing, are maintained during anesthesia. Schobert (1987) listed the dosage rates for many wild and exotic animals. Before using Telazol, the size, age, temperament, and health of the animal are considered. Following a deep intramuscular injection of Telazol, onset of anesthetic effect usually occurs within 5 to 12 minutes. Muscle relaxation is optimum for about the first 20 to 25 minutes after the administration, and then diminishes. Recovery varies with the age and physical condition of the animal and the dose of Telazol administered, but usually requires several hours.

Xylazine is a sedative (analgesic) that calms nervousness, irritability, and excitement, usually by depressing the central nervous system. Because xylazine is not an anesthetic, sedated animals are usually responsive to stimuli which can put handlers at risk if the animal reacts to stimulus. Therefore, personnel should be even more attentive to minimizing sight, sound, and touch. To minimize risks to the handler, xylazine is commonly used with ketamine to produce a relaxed anesthesia. When using ketamine/xylazine combinations, xylazine will usually overcome the tension produced by ketamine, resulting in a relaxed, anesthetized animal (Fowler and Miller 1999). This reduces heat production from muscle tension, but can lead to lower body temperatures when working in cold conditions. No federal license is required for xylazine.

Acepromazine is an immobilizing agent often used in animals as a long-term sedative and antiemetic. Acepromazine has been used to anesthetize monkeys and was injected intramuscularly at a dosage of 0.5 mg/kg along with ketamine at the same dosage. Acepromazine is also available through oral application. Oral application through application in bait could also be used for application through hand-baiting.

Chloral Hydrate, also known as trichloroacetaldehyde monohydrate, is another sedative regulated by the DEA as a schedule IV drug. Chloral hydrate can also be administered as a liquid or in a tablet form.

Midazolol, or midazolam hydrochloride, is a fast-acting benzodiazepine derivative used in the suppression of the central nervous system. Midazolol is metabolized quickly and often used for short-term sedation.

Alpha-Chloralose is a central nervous system depressant used as an immobilizing agent to capture and remove pigeons, waterfowl and other birds. However, alpha-chloralose may have application as an immobilizing drug for use on monkeys. Alpha-chloralose is typically delivered as well contained

bait in small quantities with minimal hazards to pets and humans; single baits are fed directly to the target wildlife. Personnel applying the bait are present at the site of application during baiting to retrieve the immobilized wildlife. Unconsumed baits are removed from the site following each treatment. Alpha-chloralose was eliminated from more detailed analysis in WS' programmatic FEIS (USDA 1997) based on critical element screening; therefore, environmental fate properties of this compound were not rigorously assessed. However, the solubility and mobility are believed to be moderate and environmental persistence is believed to be low. Bioaccumulation in plants and animal tissue is believed to be low. The compound is slowly metabolized, with recovery occurring a few hours after administration (Schafer 1991). The dose used for immobilization is designed to be about two to 30 times lower than the LD₅₀. Mammalian data indicate higher LD₅₀ values than birds. Toxicity to aquatic organisms is unknown (Woronecki et al. 1990), but the compound is generally not soluble in water and, therefore, should remain unavailable to aquatic organisms. Factors supporting the determination of this low potential included the lack of exposure to pets, non-target species, and the public, and the low toxicity of the active ingredient. Other supporting rationale for this determination included relatively low total annual use and a limited number of potential exposure pathways. The agent is currently approved for use by WS as an INAD by the FDA, rather than as a pesticide.

Tranquilizer Trap Devices are designed to be used with foothold traps or other live-capture traps to reduce stress and trauma after capture through the use of a tranquilizer delivery device attached to the trap. Currently, delivery devices are designed to contain a tranquilizer inside a package attached to the trap which can be punctured or chewed by the live-captured wildlife. When the device containing the tranquilizer is punctured by the animal through biting at the trap, the tranquilizer is ingested. WS' is currently evaluating the use of propiopromazine hydrochloride (PPZH) as a tranquilizer for use in delivery devices. PPZH is an immobilizing drug commonly used for cats and dogs. PPZH is currently being used by WS under an INAD authorization pursuant to the FDA regulations. The NWRC may investigate the use of PPZH as a tranquilizer for monkeys as part of methods development protocols to minimize trauma and stress experienced by monkeys when confined by restraining devices.

Several drugs and methods are available to euthanize captured animals. Euthanasia methods are completely species specific because the animal is in hand. Animals euthanized with drugs are deep buried or incinerated to avoid secondary hazards. Drugs are monitored closely and stored in locked boxes or cabinets according to WS' policies, to policies of the respective cooperating agencies, to the DEA, or to FDA guidelines. Most drugs fall under restricted-use categories and must be used under the appropriate license from the DEA which WS does hold. Administration of euthanizing drugs will only be performed by personnel trained in proper handling and euthanasia techniques. Training on the proper handling and euthanizing techniques for non-human primates will be provided by the NWRC, AC, or other appropriate entities. Euthanizing drugs will only be administered when monkeys are under physical or chemical restraint to allow for drugs to be administered properly. Anesthetic drugs will be administered prior to administration of euthanizing drugs.

Sodium Pentobarbital is a barbiturate that rapidly depresses the central nervous system to the point of respiratory arrest. There are DEA restrictions on who can possess and administer this Schedule II drug. Some states may have additional requirements for personnel training and particular sodium pentobarbital products available for use in wildlife. Personnel will be trained in the use of sodium pentobarbital. All employees using the drug will be certified and authorized in accordance with DEA regulations.

Beuthanasia[®]-D and other FDA approved chemical euthanizing solutions contain two active ingredients (sodium phenytoin and sodium pentobarbital) which are chemically compatible but pharmacologically different. When administered intravenously⁹, sodium pentobarbital produces rapid anesthetic action followed by a smooth and rapid onset of unconsciousness. When administered intravenously, sodium phenytoin produces toxic signs of cardiovascular collapse and/or central nervous system depression; hypotension occurs when the drug is administered rapidly. Sodium phenytoin exerts its effects during a deep anesthesia stage caused by sodium pentobarbital. Sodium phenytoin, due to its cardiotoxic properties, hastens the stoppage of electrical activity in the heart, causing a cerebral death in conjunction with respiratory arrest and circulatory collapse. Cerebral death occurs prior to the cessation of cardiac activity.

Beuthanasia[®]-D is regulated by the DEA and the FDA for rapid and painless euthanasia of dogs, but legally may be used on other animals if the animal is not intended for human consumption (WS Directive 2.430).

Potassium chloride, a common laboratory chemical, may be used as an euthanizing agent after an animal has been anesthetized, and is considered acceptable and humane by the AVMA for free-ranging wildlife when appropriately anesthetized (AVMA 2007). Potassium chloride is not a federally-controlled substance. Anesthetized animals injected with potassium chloride experience cardiac arrest followed by death. Animals that have been euthanized with potassium chloride are not toxic to scavengers. However, anesthetizing agents may pose secondary hazards to scavengers. All monkeys euthanized will be disposed of through deep burial or through incineration.

⁹ Intravenous injection is the most rapid, reliable, and desirable euthanasia technique for administering sodium pentobarbital. Intraperitoneal injection may be used when it would cause less distress than intravenous injection (AVMA 2007).