LUTZ DIRKSEN

Green Anacondas (*Eunectes murinus*) are the most widely distributed species of anacondas. Although some pythons may attain greater lengths, no other snake is as massive. These snakes are found in most tropical lowland habitats east of the Andes. Although any use of the Green Anaconda is prohibited by Venezuelan law, illegal harvests are common. Between 1988 and 1990, international authorities confiscated 2,138 anaconda skins in Holland that supposedly originated in Venezuela.

Conservation of Green Anacondas: How Tylenol Conservation and Macroeconomics Threaten the Survival of the World's Largest Snake

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Many biologists consider economics and politics to be bad words. Because we are not trained in their use and implications, we often prefer to avoid issues that involve those topics. Consequently, when we discuss the economics of conservation, we usually talk about economic incentives for conservation and sustainable use of natural resources, but often fail to delve more deeply. We identify the cost of a commodity from nature, what its exploitation represents from an environmental perspective, and what economic incentives might filter down to the populace, but we almost always lose sight of the larger macroeconomic framework in which such discussion belongs. For this reason, the solutions we offer often fail to address the real economic needs of both natural and human communities, and our proposed solutions frequently are vulnerable to fiscal and political pressures that fail to consider that the environment is more than a source of commodities. Herein, I will discuss the macroeconomic situation in Latin America and the impact that politics and economic policies have had on conservation, and specifically how these affect anacondas and related conservation issues in South America.

TONY CROCCETTA

Capturing Green Anacondas can be difficult. Although snakes are large and can inflict painful bites, they move slowly compared to many smaller snakes, and can be handled safely by experienced personnel.

The Problem of Conservation

Visitors to rural areas of Latin America have enjoyed beautiful landscapes and pristine natural ecosystems alongside the less-pleasurable experiences of seeing how the local people live. Their economic limitations and struggles make it immediately clear that no amount of education or enforcement of regulations can (and should?) prevent them from using natural resources for their own survival (McSweeney 2005). People living in a money-driven system with few means of obtaining money are easily persuaded to exploit nature in an unsustainable fashion. The sale of wildlife is a common example (e.g., Fitzgerald et al. 1991, Robinson and Redford 1991, Vickers 1991). Whether they use nature unsustainably of their own accord, due to lack of education and environmental awareness, or are encouraged (or forced) by external commercial interests (e.g., Camhi 1995), abject poverty is the primary problem and no conservation program can succeed without addressing it.

Neoliberal Economic Policies

For the last half century, international economic agencies (IEAs), such as the World Bank (WB), the International Monetary Fund (IMF), and the United States Agency for International Development (USAID), have been actively promoting development by injecting money into the national economies of underdeveloped nations. The idea is to stimulate those economies, eventually providing countries with the means to pay back the money received (e.g., World-Bank 2001, Kütting 2004, Clapp and Dauvergne 2005). However, reality differs; nations that have received the most economic "help" have experienced dramatic increases in poverty (e.g., Buhdoo 1994, Rich 1994, Jochnick 2001, Navarro-Jimenez 2004). The problem seems to be that help comes with strings attached. These "strings," called structural adjustment programs (SAPs), may include decreasing or eliminating internal subsidies for agriculture, dropping trade barriers, allowing international companies to operate in the

CAROL FOSTER

Capable of taking large prey, Green Anacondas, nevertheless, are often injured during the struggle. This snake is ingesting a Capybara (*Hydrochaeris hydrochaeris*), which inflicted the bite responsible for the large wound.

WILLIAM HOLSTROM

During the breeding season, as many as 13 male Green Anacondas have been observed competing to mate with a single female, with the mating aggregation lasting as long as four weeks. Here, eight males court a female in Venezuela. Females may mate with more than one male during the breeding season.

WILLIAM HOLSTROM

Green Anacondas are ambush predators on aquatic prey or animals that come to the water to drink. This adult female (SVL 363 cm, 40 kg) regurgitated a 10-kg White-tailed Deer (*Odocoileus virginianus*) shortly after capture.

country, granting exceptions to environmental regulations, eliminating social benefits, and relaxing labor laws.

Also, money must often be used to hire specific transnational companies. Such entities are known as export credit agencies (ECAs) and often are associated with the government of a developed country. Consequently, much of any loan never reaches the country it is supposed to benefit, moving instead from one bank account to another in a developed nation (e.g., Goldzimer 2003, Perkins 2004, Clapp and Dauvergne 2005). ECAs hire employees at minimum wage, but since SAPs impose lower wages and drop social assistance and workers' benefits, the minimum wage does not really address poverty. People have jobs, but the costs of essential commodities (produce, water, housing) have gone up because the workers are now part of a global market. Consequently, the local standard of living drops (e.g., Horta 1991, Cheru 1992, Yunus 1994).

Such a neoliberal agenda can lead to environmental degradation. People use resources in an unsustainable manner and companies dump pollutants (in part due to the lowering of environmental standards originally intended to spur economic growth). Both result in habitat deterioration (e.g., Horta 1991, Cheru 1992, Rich 1994, Pearce et al. 1995, Horta et al. 2002). Especially when companies are temporary, like those involving mining or logging, departure leaves behind pollution, destroyed habitat, unemployment, and even more poverty than existed previously (e.g., Goldzimer, 2003). One example is Argentina, which embraced a neoliberal agenda wholeheartedly during the late 1990s. In 2002, the bubble burst, leaving the country in great poverty (Blustein, 2005). The crash of the Argentinean economy was followed by political upheaval and economic and social turmoil. Such social unrest has caused a series of uprisings in South America, toppling presidents in Argentina (2002), Bolivia (2003, 2005), and Ecuador (1997, 2000, 2005). Needless to say, during times of economic and political upheaval, conservation takes a back seat.

Economy and the Environment

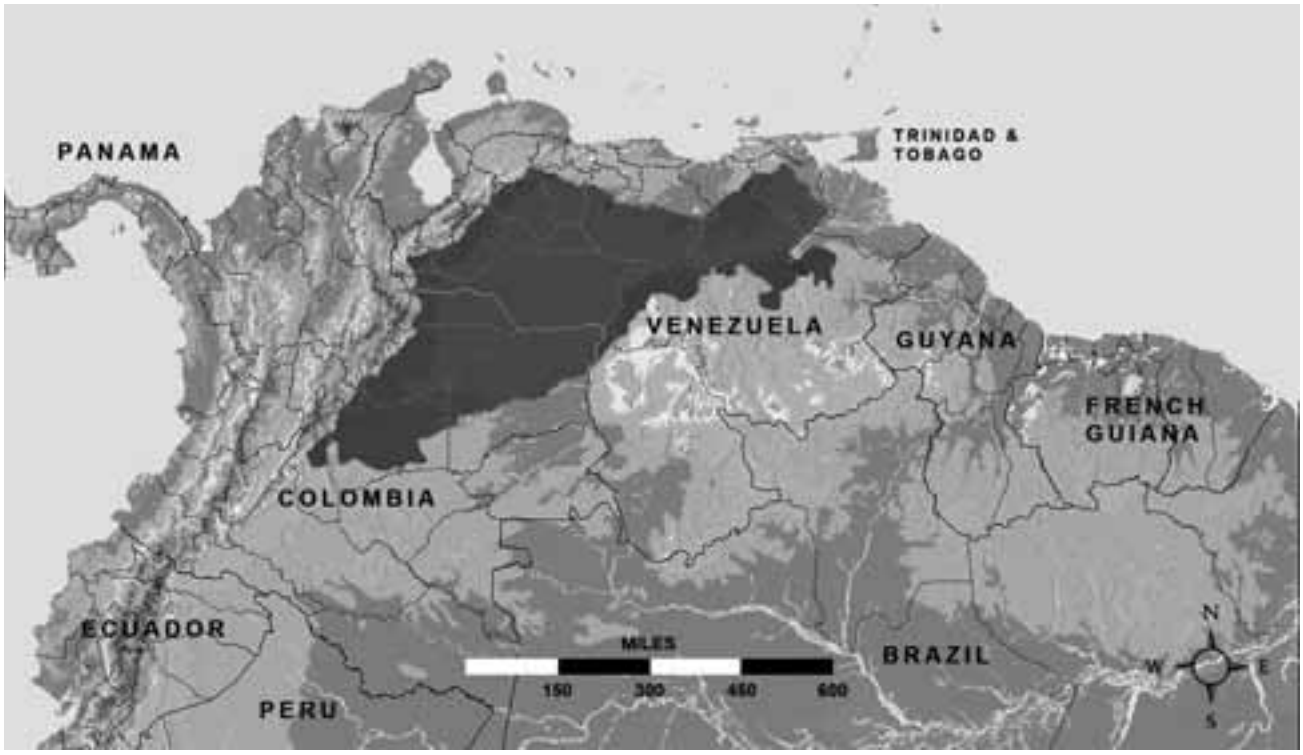
The sustainable use of natural resources has been offered as one potential solution to economic problems, with the rational use of wildlife as an alternative to destruction of natural habitats. Sustained harvest of wild populations has been implemented in several countries for subsistence (Robinson and Redford 1991, Shaw 1991, Silva and Strahl 1991, Vickers 1991, Balick and Mendelson 1992, Bodmer et al. 1997) and commercial purposes such as hides, meat, or live pets (Fitzgerald et al. 1991, Groom et al. 1991, Beissinger and Bucher 1992, Joanen et al. 1997). For example, several endangered crocodilians are recovering in response to effective harvesting practices (see Thorbjarnarson et al., 1992 for a review).

Wildlife Management and Conservation in Venezuela

Venezuela has withstood the economic crisis better than other Latin-American countries, primarily due to the country's oil reserves. However, from 1982 to 1998, the economy slowly but consistently declined. As the economy of the country deteriorated and wages fell, people were forced to rely on unconventional resources. For instance, in the past, traditional consumption of Capybara (*Hydrochaeris hydrochaeris*) meat was restricted to the week before Easter. More recently, illegal hunting of Capybaras extended throughout the year, as people resorted to Capybara meat as a staple. Traditionally, most of the country's meat came from Rancho El Frío. For more than 30 years, El Frío had sustained an estimated population of roughly 30,000

TONY GROCCETTA

This carcass of a Green Anaconda was found on the parched savanna. Snakes moving in the dry season searching for water occasionally fail to find a cool refuge during the heat of the day.



The Venezuelan llanos (= flatlands) are characterized by vast grasslands with ribbons of forest along creeks and rivers. It is an environment of harsh extremes, severe droughts alternating with floods. The llanos are sparsely populated by humans, with most inhabitants engaged in raising cattle. The llanos are Venezuela's greatest repository of wildlife.

Capybaras, of which about 10,000 were harvested annually (Ojasti, 1991). In 1986, I participated in a survey of El Frío Capybaras that recorded a population of only slightly above 4,000 animals. Later surveys showed an additional decrease in the population, with poaching acknowledged as the leading cause of the population crash. This trend is, not surprisingly, expected to continue and extend to other species as poverty in the country becomes increasingly prevalent.

Pressures on Anaconda Populations

Although any use of the Green Anaconda (*Eunectes murinus*) is prohibited by Venezuelan law, illegal harvests are common. Between 1988 and 1990, international authorities confiscated 2,138 anaconda skins in Holland that supposedly originated in Venezuela (Profauna archives). Among the confiscated hides were skins of *E. murinus*, which occurs in Venezuela, and of Yellow Anacondas (*E. notaeus*), which occur only in southern South America. When I and my collaborators started studying anacondas in 1992 (Rivas et al. 2007), I learned that tanneries were paying the equivalent of U.S. $16.67 per meter of skin. This is a significant amount for a worker whose income otherwise averages about $3.50 a day.

Legal low-profile anaconda harvests occur in several South American nations. In Guyana, anacondas are harvested opportunistically by fishermen and sold to local tanners (Mirna Quero, pers. comm.). Yellow Anacondas have been harvested legally in Argentina (Waller et al., 2007) and illegally in Paraguay (P. Micucci, pers. comm.). Bolivia had initiated studies investigating the sustainable use of *E. murinus*, but political unrest halted the development of the program (J. Aparicio, pers. comm.).

Farming versus Harvesting Anacondas

The most common methods of extractive wildlife management are farming, harvesting, or some combination of both. In a farming model, animals are kept in captivity, a relatively expensive proposition, but practical for animals with fast growth rates, low maintenance expenses, and capable of being held in high densities. Traditional farming of Green Anacondas is not practical. The cost of facilities and maintenance would be prohibitively high. Also, anacondas take several years to reach adulthood, and females breed only every other year at best (Rivas, 2000).

However, an "open farm system" may be possible. Large pregnant females can be found along the riverbanks (Rivas 2000, Rivas et al. 2007b), caught, kept in captivity, and released after they deliver. Due to high fertility (Rivas, 2000), a large number of individuals can be produced quickly. Neonates have a high natural mortality in the field (Rivas 2000, Rivas et al. 1999, 2001, 2007b). Releasing some percentage of individuals subjected to lower captive mortality rates would presumably equal the number that would have survived to that age in nature. Neonates can grow quickly (Holmstrom 1982, Rivas et al. 2007b), and, after a relatively short period in captivity, could provide scar-free, small-scaled skins with high value on the legal market.

Anacondas do not make good pets. They quickly outgrow cages, and become a risk to other pets and even people. They

have an aggressive temperament and never become an easy (or safe) animal to handle. They also release a fetid musk when disturbed. Nevertheless, anacondas remain popular and potentially profitable (approximately $250/neonate, retail). The illegal import of live reptiles for the pet trade continues to grow (Hoover 1998). This market is hard to control, and the number of animals being extracted from nature is difficult to quantify. A legal source of neonates from a sustainable system could serve to protect the wild population.

Closed-system farming would benefit only the few people working on the farm, and does not require pristine habitat. Consequently, farming has at best a modest impact on the local economy (Thorbjarnarson 1999). So, although sustainable, farming would not be a constructive conservation method, but merely business as usual, differing only in the use of a wildlife commodity. A system of open farming, involving the capture and post-parturition release of adult females, on the other hand, has potential as a conservation tool because it requires a pristine environment where the animals live.

In contrast, in a cropping system, animals are harvested from the wild; thus a direct link exists between the economic activity and the conservation of the species and its habitats. Economic incentives are directly linked to habitat preservation, and thus cropping has real potential for use as a conservation tool. Harvesting is best suited for animals that occur in high densities and are easy to find and catch. Overhead is much lower than for farming, since the only investment involves finding and catching animals (product storage and transport to market is an inevitable component of either method). However, harvesting has a much greater potential for detrimental effects on natural populations. Monitoring and controlling the harvest are high priorities that can be very expensive and potentially troublesome.

Estimating Numbers

Before attempting the management of any species, we must understand its basic life history. Even modest success at wildlife management depends upon some knowledge of demography, especially abundance, rate of increase, fecundity, mortality, recruitment, and dispersal. Estimates of population size and the intrinsic rate of increase are necessary in order to calculate the maximum sustainable yield (MSY; the maximum number of individuals that can be removed from a population while maintaining population size).

TONY RATTIN

This female Green Anaconda (410 cm SVL, 44 kg) is being courted by 12 males.

Because anacondas are secretive, we cannot accurately determine the total number of animals in any area. An alternative is to estimate the population size using an index of relative abundance (e.g., number of snakes seen per km of road). This way we can propose a conservative MSY, refine it by monitoring the impact of harvesting with repeated surveys, detecting any problems, and adjusting the take in a timely fashion (Caughley, 1977; Caughley and Sinclair, 1994). To date, however, we lack any estimate of anaconda abundance, which would require long-term mark and recapture studies, nor do we have any index of relative abundance — and none of the traditional methods are easily applied. One possibility would be to count sightings of pregnant females along riverbanks or edges of roads, where they frequently bask. In the interim, the lack of a field-based method for monitoring the impact of a cropping program, commercially exploiting anacondas could result in over-harvesting.

Capturing animals presents another challenge. Looking for anacondas is probably not cost-effective in light of the low frequency of capture that I have encountered (Rivas et al. 2007b). One option would be to combine harvests of anacondas with that of other potentially valuable species such as Spectacled Caimans (*Caiman crocodilus*), turtles (*Podocnemis* spp), Common Iguanas (*Iguana iguana*), and Common Tegus (*Tupinambis teguixin*) (Thorbjarnarson and Velasco 1999). All of these reptiles occur in relatively high densities and are potentially manageable. However, implementation of a sustainable management plan for any or all of these species requires basic knowledge about their populations in any given area — knowledge that is currently lacking.

Hunters typically target the largest individuals (males in many exploited species), because they provide more skin or meat. In polygynous species (in which a male mates with more than one female in a single breeding season), this is potentially sustainable, since most matings are by only a few males, leaving a theoretical surplus available for harvesting. Anacondas, however, are polyandrous (in which a female mates with more than one male in a single breeding season; Rivas 2000, Rivas and Burghardt 2001, Rivas et al. 2007a, 2007b) and females are larger. Also, the largest females contribute the most offspring (females >340 cm are responsible for nearly 60% of new offspring every year, and females >300 cm contribute nearly 75% of each new generation; Rivas, 2000). In other words, harvesting practices biased for large females would dramatically and quickly impact population numbers.

Harvesting males would seem to be a feasible alternative. They are easier to find, can be gathered in greater numbers in breeding aggregations, and have skins with fewer scars because they are smaller in size and feed on less dangerous prey (Rivas 2000, Rivas and Burghardt 2001, Rivas et al. 2007b). However, females that are courted by several males have higher reproductive success (Rivas, 2000), so the quota of males would have to be assessed very carefully, and hunters may not accurately discriminate males from females.

Sustained commercial use of large snakes appears to work in Sumatra, where Reticulated Pythons (*Python reticulatus*), Blood Pythons (*Python brongersmai*), and Short-tailed Pythons

(*Python curtus*) are harvested serendipitously near plantations and villages (Shine et al., 1999). This method targets mostly males due to their higher mobility, and produces a variable rate of harvest that changes with snake abundance. Because hunters are not targeting snakes, this method of hunting has the potential to be self-regulating. A drop in the population will produce a lower encounter rate that will result in a lower harvest. A similar method is used for Green Anacondas in Guyana, where fishermen gather snakes opportunistically. Like the python harvest, this method seems to be sustainable, although quantitative data are lacking. However, increases in poverty levels of rural inhabitants can dramatically increase the levels of harvesting.

Management of Anacondas

Anacondas and other boids are listed in CITES Appendix II, which requires permits be obtained for any commercial trade. In Venezuela, anacondas remain abundant due to large expanses of relatively undisturbed wetland habitats (Rivas et al. 2002). No legal commercial trade exists, and the illegal market for skins places little pressure on populations at the moment. Although edible, anacondas are not eaten. Other than the skin, the only product of value is the fat. Melted anaconda fat is considered a medicine for throat problems, asthma, and other respiratory ailments. However, the demand is low and localized. Because selling anaconda products is illegal, few campesinos engage in harvests. Instead, the main reason that local people kill anacondas is because they fear and dislike them. Arguments that anacondas eat poultry, livestock, pets, or even people are often used to justify killing snakes.

Habitat degradation in the llanos has not yet been a serious problem, since most land use for cattle involves increasing the area covered by water for longer periods (Rivas et al. 2002). The impact of extensive cattle ranching on wildlife here is much lower than the impact in the United States or other countries where cattle are kept at higher densities. However, old-fashioned ranching practices involve cutting forests to ease handling of livestock (that often hides in the forest and becomes feral) and allow easy access to water in dry season. Federal laws prohibit deforestation within 50 m of a river, but this regulation is seldom enforced. Deforestation increased dramatically in the late 1990s. Riverbanks often develop "caves" that are supported by tree roots, and these caves are frequently used as refugia by anacondas. In the treeless savanna, anacondas have fewer places to hide and escape from extreme drought. This can be important in atypical years during which anacondas may be exposed to extreme heat (Rivas 2000, Rivas et al. 2007b). Caves along segments of rivers without forest are less abundant and smaller than those in other areas because the lack of roots allows erosion. Cutting the forest is a direct threat to anacondas, in addition to the effects of deforestation on populations of prey species and other components of forest ecosystems.

Management as a means of incorporating use of anacondas into economic development plans is difficult, and more research is needed. Harvesting males, as well as farming of neonates, are

TONY CROCCETTA

Much of the Venezuelan llanos is managed for cattle, with dikes used to hold water for the dry season. Consequently, encounters between cowboys and snakes occur frequently.

Spectacled Caimans in Venezuela

In 1986, the Venezuelan government initiated the harvest of Spectacled Caimans (*Caiman crocodilus*). This program operates on private lands, where owners hire a biologist to survey the population, and, based on the estimate of population size, Profauna licenses a given quota. Owners hire people to harvest and process the animals. Skins are bought by tanners that prepare the skins to crosta (one step of the tanning process) and sell them to overseas companies that manufacture the final products. This program provides some benefits to landowners, to local workers, to biologists who conduct surveys, and to tanners who process and export skins. Relying on a prolific species of high commercial value that is relatively easy to count and harvest (Thorbjarnarson and Velasco 1999), the program would appear to be a perfect example of conservation management.

Regardless of potential and good intentions, the program has been engaged in a battle of wits with poachers who took advantage of loopholes in the regulations. Once the word got out that a square foot of caiman skin was worth $40, no safe havens remained for the animals. Every effort to tweak legislation was matched and overmatched immediately by new means of circumventing the law. Landowners would kill and market caimans from surrounding areas to keep their own populations high in future surveys. Efforts to count skulls and carcasses and match them with the number of skins were implemented to ensure that caimans were killed where permits allowed (carcasses are too heavy to carry on burros, causing poachers to retrieve only skins). This immediately spawned a new breed of entrepreneur, whose business consisted of renting truckloads of rotting carcasses to crooked landowners. This is only one example of the many tricks that Profauna had to uncover in their effort to implement the program. Many of the people who were supposed to be involved in the management of a sustainable resource never perceived it as anything other than an ephemeral source of wealth. Consequently, this resulted in dramatic population declines in many areas (Thorbjarnarson and Velasco 1999). This program was unsuccessful not only because it failed to convince locals that it was a long-term program capable of providing sustained revenues, it also failed to provide adequate economic incentives to the local populace, who never saw the need to protect the resource.

F. WAYNE KING

In 1986, the Venezuelan government initiated the harvest of Spectacled Caimans (*Caiman crocodilus*) on private lands. Photograph copyright © 1996 Florida Museum of Natural History, used with permission (http://www.flmnh.ufl.edu/natsci/herpetology/CROCS/Crocpics.htm).

possible alternatives that can be explored. However, both practices involve many logistical problems in addition to ethical issues that cannot be ignored. Killing animals for human comfort and leisure is an ongoing theme of heated debates between those concerned with animal welfare and those who manage wildlife for profit (Robinson 1993, Joanen et al. 1997, Struhsaker 1998, McLarney 1999, Medellin 1999). New regulations adopted by the international community regarding import of exotic wildlife, in the name of conservation or animal welfare, can limit the market and jeopardize investments made by producers. Importing live animals raises ethical issues regarding the welfare of pets that might end up in the hands of novice pet owners who do not maintain animals in optimal conditions. In the case of larger reptiles, an additional problem arises when an animal reaches a size at which it is difficult to keep. Frequently, animals are released in exotic environments where they usually die of exposure or starvation. If they survive and reproduce, further problems arise as a consequence of exotic invaders in foreign ecosystems (Atkinson 1989, Snow et al. 2007). For instance, Green Anacondas have been found in the Florida Everglades (Snow et al. 2007), although evidence of reproduction is lacking.

Many countries have resorted to exploiting wildlife to solve economic crises. In Venezuela, recommendations resulting from my research have largely stemmed plans to commercially harvest anacondas, but less out of concern for the resource than because the abundance of oil has relieved part of the pressure on the economy. At the moment, anacondas are at little risk of being harvested in Venezuela. However, poverty in rural areas throughout South America, increased human encroachment, and political and economic turmoil continue to threaten the species, and these threats are expected to increase.

I suggest that the least difficult and controversial benefit to local communities vis-à-vis anacondas is the lure that a "charismatic mega-fauna" provides for ecotourism. The llanos has a tremendous and unrealized potential for ecotourism due to the large abundance and diversity of wildlife, which is comparable to that of the Amazonian rainforest (Rodríguez and Rojas-Suarez 1996). However, in the vast savannas of the llanos, animals are readily spotted and appreciated. Reinvesting profits generated by ecotourism in the local community in terms of jobs, education, and welfare are vital if ecotourism is to succeed as a conservation tool.

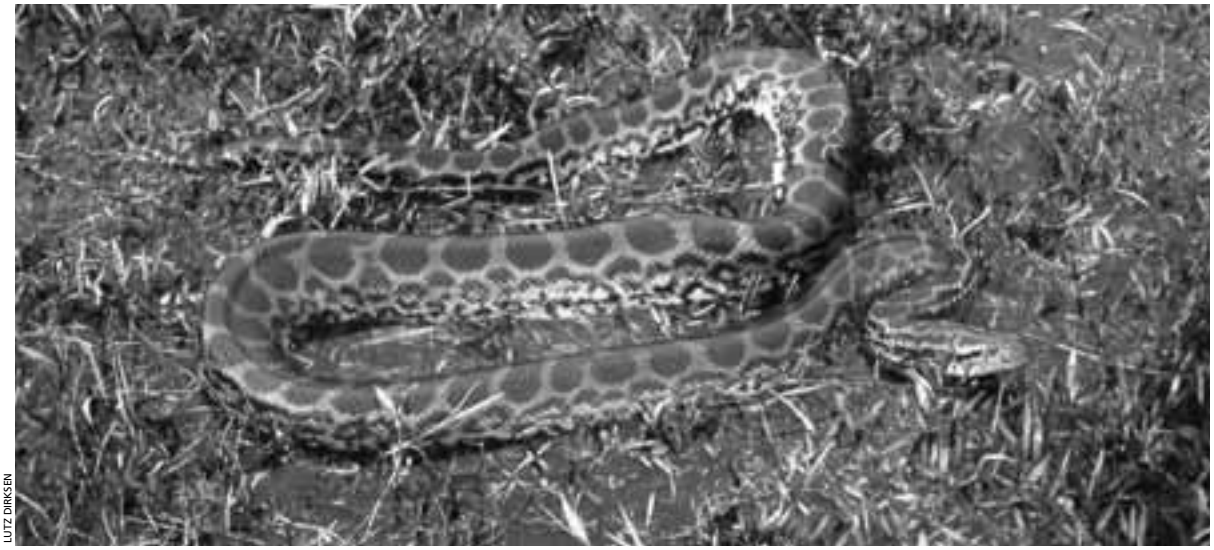
Yellow Anacondas in Argentina[1]

An experimental harvest of Yellow Anacondas (*Eunectes notaeus*) has been implemented in Formosa Province, Argentina. The program encouraged indigenous peoples and rural mestizos to catch snakes over 2.3 m in length that were found opportunistically during the months of August–October, the beginning of the warm season. The 2.3-m length was determined by the fact that skins of that size were 23 cm wide, the minimum necessary for making purses without patching pieces together. Locals were paid 15–20 pesos (= ~$4–5.40), depending on the size of animals. No quotas or restrictions on where animals were caught were imposed. The economic benefits can represent an important part of the locals' annual budget in an area where farmers live on incomes of about $150/year. However, the people who took the lion's share of proceeds were higher in the economic chain. Skins were sold to shoe- and purse-making factories at $50 per meter. So, a snake that was, for example, 3 m in length, was bought for $4 by the tanner and then sold for $150 to make purses worth several hundred dollars. If local people had benefited adequately, they would have become guardians and active stewards of the land. Instead, the program was less of an effort to manage anacondas than an economic enterprise using anacondas as a capital commodity.

To place this program into economic and political contexts, we have to realize that the country's neoliberal constitution (1994) established autonomy for the provinces over their natural resources, which took the decision-making away from the central government. Consequently, for example, if an association of tanners proposed a program to the central government offering to inject $100K into the economy, it would not be nearly as tempting for the nation's government as it would be for that of a small province. By allocating the decision-making to smaller authorities, persuasion of those authorities by offers that might not be in the best interests of the country or the environment is much easier.

Yellow Anacondas are smaller than Green Anacondas, but share a female-biased sexual size dimorphism. Because 2.3 m in length is about the upper limit on the size of males, this harvesting plan pretty much guarantees the exclusive harvesting of females. Furthermore, animals are found primarily by searching for individuals basking on dense vegetation, and the only snakes that regularly bask are pregnant females (Rivas, 2000). Conversations with local harvesters indicated that they anticipated a sharp decline in anacondas due to the large number of females harvested.

[1] **Editor's note:** An Argentinian NGO (Fundación Biodiversidad) developed and proposed this plan to the National Government in 2001. It later became the first experimental approach (possibly worldwide) for the adaptive management of a boid that has been hunted historically and massively regardless of any law or biological consideration. The Program (which generates skins for international trade) deals with a CITES Appendix II species, requiring its management to comply with Article IV (non-detrimental finding) of the Treaty. The Fundación Biodiversidad must provide annual reports to the National Government (CITES Authority) in order to renew export authorizations and comply with CITES requirements. The program is monitored closely, which allows detection and correction of any problems that might arise. Waller et al. (2007) noted that: "For the first time in more than 20 years, biologists were able to design and test a harvest methodology for this traditionally exploited species. The experimental harvest began in 2002, and approximately 5,000 skins of an average length of 2.6 m were obtained in Formosa each year between 2002 and 2004, following strict administrative and technical procedures (Micucci et al., 2006)." An article describing the plan in detail will appear in the next issue of *IGUANA*.



LUTZ DIRKSEN

An experimental harvest of Yellow Anacondas (*Eunectes notaeus*) has been implemented in Formosa Province, Argentina.

Management versus Conservation

Conservation and use of wildlife are not detached from other economic and political issues, and we cannot address the former without considering the latter. Common tendencies are to use the natural resources for profit without an environmental agenda by exploiting opportunities and funds provided by conservation. Such an approach is not sustainable, although it appears to use natural resources in a "green" manner. In fact, such activities may harm conservation efforts. The use and depletion of natural resources in the name of conservation give it a negative image, which, in turn, drains funds and distracts attention from real solutions.

Business or Conservation?

When management is used for conservation, the economic incentives are tools for encouraging local people to protect the environment. The purpose of assigning an economic value to a resource is to provide stewards of the land reasons for protecting it. The alternative is exploiting the environment for commercial gain. The latter, however, may involve businesses that use resources in a sustainable manner and are environmentally friendly or businesses that loot the environment for short-term profit. While sustainable use is a legitimate practice, it differs from conservation measures in that the priority is maximizing gains.

Impact of Neoliberalism on Conservation

Despite evident declines in Venezuelan caiman populations (see Box) (Thorbjarnarson and Velasco, 1999), Profauna chose to ignore repeated warnings of over-exploitation from the scientific community, probably because the agency depended on the revenues generated by sales of caiman skins. A program is inherently flawed when the people who administer a resource are dependent on the exploitation of that resource. This is an example of a larger problem. In the late 1980s, Venezuela was heavily influenced by a neoliberal agenda (Larrea, 2004). Recommended measures for economic development (SAPs) demanded that the government did not sponsor research or any other activities that were not linked to administration of resources; instead, self-financing became the mantra of the relevant governmental agencies. The laws of supply-and-demand should rule the system (Navarro-Jimenez 2004). However, because managers had to compromise their own jobs if they took any action to stop the program, they did not respond to evidence of declines. In fact, when the program slowed solely due to the increasingly low density of caimans, Profauna underwent major structural changes, downsized, and eventually disappeared.

The Argentinean program for harvesting Yellow Anacondas (see Box) also embraced a neoliberal agenda. During the late 1990s, economic growth had slowed and the nation was facing serious economic problems. By the end of 2001, the IMF pulled out and the economy crashed (Blustein 2005), rendering imperative the exploitation of a natural resource. Tanners in Formosa Province provided a fund of $100,000 for harvesting anacondas, a juicy contribution to a stagnant economy. The whole system depended on the urgent need to produce cash to ameliorate the economic crises. Turning down a business opportunity was not an option.

NATIONAL GEOGRAPHIC, USED WITH PERMISSION

Bundling Green Anaconda skins for transport to the tanning plants.

The Fallacy of Tylenol Conservation

Choosing to ignore or deny the impact of macroeconomics on conservation will not lead to a solution. We cannot address the problems of conservation unless we acknowledge the root cause. Ignoring the big problems by trying to address those that are easier or cheaper to solve is the fallacy of "Tylenol Conservation." Taking a painkiller rather than addressing the underlying problem often results in the need for more and stronger painkillers as time passes. A similar approach in conservation creates an illusion that we are working to make a difference while distracting us from addressing the real issues.

Another example of Tylenol conservation is the tendency to identify and protect areas of high diversity, when the real solution is addressing threats to the land. Protective legislation is, like a painkiller, a handy tool, but not a solution to the problem. In Latin America, extreme poverty is the underlying cause of conservation problems. Protecting a piece of land, education, and providing some economic relief for locals through wildlife management or ecotourism are laudatory, but are only painkillers that provide, at best, only temporary relief.

The main point with which I want to leave the reader is that conservationists must realize that politics and macroeconomics are not dirty words, but simply disciplines in which we need to be involved. If we really want to make a difference in conservation, we need to attack the roots of problems and causes — and the origins of conservation problems are rarely biological. Instead, economic, social, and political issues are often responsible. Integrating concerns about environmental degradation and loss of biodiversity with support of movements for sustainable economies and perhaps even anti-neoliberal globalization movements can result in more effective solutions with better chances for long-term successes.

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Literature Cited

Atkinson, I. 1989. Introduced animals and extinctions. In: D. Western and M. Pearl (eds.), *Conservation Biology for the Twenty-First Century*. Oxford University Press, New York.

Balick, M.J. and R. Mendelson. 1992. Assessing the economic value of traditional medicines from tropical rainforests. *Conservation Biology* 6:128–129.

Beissinger, S.R. and E.H. Bucher. 1992. Sustainable harvesting of parrots for conservation, pp. 73–115. In: S.R. Beissinger and N.F. Snyder (eds.), *New World Parrots in Crisis*. Smithsonian Institution Press, Washington, D.C.

Blustein, P. 2005. *And the Money Kept Rolling In (and Out): Wall Street, the IMF and the Bankrupting of Argentina*. Public Affairs, New York.

Bodmer, R.A., J.A. Penn, P. Puertas, L. Moya, and T.G. Fang. 1997. Linking conservation and local people through sustainable use of natural resources: Community-based management in the Peruvian Amazon, pp. 315–358. In: C.H. e. Freese (ed.), *Harvesting Wild Species: Implications for Biodiversity Conservation*. John Hopkins University Press, Baltimore, Maryland.

Buhdoo, D. 1994. IMF/World Bank wreak havoc on the Third World, pp. 20–23. In: K. Danaher (ed.), *50 Years Enough: The Case Against the World Bank and the International Monetary Fund*. South End Press, Boston, Massachusetts.

Camhi, M. 1995. Industrial fisheries threaten ecological integrity of the Galapagos Islands. *Conservation Biology* 9:715–719.

Caughley, G. 1977. *Analysis of Vertebrate Populations*. John Wiley and Sons, New York.

Caughley, G. and A.R. Sinclair. 1994. *Wildlife Ecology and Management*. Blackwell Scientific Publications, Oxford.

Cheru, F. 1992. 1992 Structural adjustment, primary source trade and sustainable development in Sub-Saharan Africa. *World Development* 20:497–512.

Clapp, J. 2001. *Toxic Exports: The Transfer of Hazardous Wastes from Rich to Poor Countries*. Cornell University Press, Ithaca, New York.

Clapp, J. and P. Dauvergne. 2005. *Path to a Green World*. The MIT Press, Cambridge, Massachusetts.

Fitzgerald, L.A., J.M. Chani, and O.E. Donadio. 1991. *Tupinambis* lizards in Argentina: Implementing management of a traditionally exploited resource, pp. 303–316. In: J.G. Robinson and K.H. Redfort (eds.), *Neotropical Wildlife Use and Conservation*. Chicago University Press, Chicago, Illinois.

Goldzimer, A. 2003. Worse than the World Bank? Export Credit Agencies, the secret engine of globalization. *Food First Backgrounder* 9(1).

Groom, M.J., R.D. Podolsky, and C.A. Munn. 1991. Tourism as a sustained use of wildlife: A case study of Madre de Dios Southern Perú, pp. 393–412. In: J.G. Robinson and K.H. Redford (eds.), *Neotropical Wildlife Use and Conservation*. Chicago University Press, Chicago, Illinois.

Holmstrom, W.F. 1982. *Eunectes* (anacondas): maturation. *Herpetological Review* 13:126.

Hoover, C. 1998. The US role in the international live reptiles trade: Amazon tree boas to Zululand dwarf chameleons. TRAFFIC North America, Washington, D.C. (http://www.traffic.org/reptiles/).

Horta, K. 1991. Multilateral development institutions bear major responsibility on solving Africa's environmental problems, pp. 21–28. In: P. LeBel (ed.), *Environmental Policies for Sustainable Growth in Africa. Proceedings of the Fifth International Conference*. Montclair State University, Upper Montelair, New Jersey.

Horta, K., R. Round, and Z. Young. 2002. The global environmental facilities: The first ten years — growing pains or inherent flaws?, p. 36. In: *Environmental Defense and Halifax, NS*. The Halifax Initiative, Washington, D.C.

Joanen, T., L. McNease, R.M. Elsey, and M.A. Staton. 1997. The commercial consumptive use of the American Alligator (*Alligator mississippiensis*) in Louisiana: Its effect in conservation, pp. 465–506. In: C.H. e. Freese (ed.), *Harvesting Wild Species: Implications for Biodiversity Conservation*. John Hopkins University Press, Baltimore, Maryland.

Jochnick, C. 2001. Perilous prosperity. In: New Internationalist 335 (http://www.thirdworldtraveler.com/South_America/Perilous_Prosper_Ecuador.html).

Kütting, G. 2004. *Globalization and the Environment*. State University of New York Press, Albany.

Larrea, M. 2004. El referendo y la descolonización de Venezuela. In: Red Voltaire (http://www.voltairenet.org/article122533.html?var_recherche=Larrea?var_recherche=Larrea).

McLarney, W.O. 1999. Sustainable development: A necessary means for effective biological conservation. *Conservation Biology* 13:4.

McSweeney, K. 2005. Indigenous population growth in the lowland Neotropics: Social science insights from biodiversity conservation. *Conservation Biology* 19:1375–1384.

Medellin, R.A. 1999. Sustainable harvest for conservation. *Conservation Biology* 13:225–227.

Micucci, P.A., T. Waller, and E. Alvarenga. 2006. Programa Curiyú. Para la conservación y aprovechamiento sustentable de la Boa Curiyú (*Eunectes notaeus*) en la Argentina. Etapa experimental piloto 2002–2004, Formosa, pp. 77–92 In: M.L. Bolkovic and D. Ramadori (eds.), *Manejo de Fauna Silvestre en la Argentina. Programas de Uso Sustentable*. Dirección de Fauna Silvestre, Secretaría de Ambiente y Desarrollo Sustentable, Buenos Aires, Argentina.

Navarro-Jimenez, G. 2004. *Geopolítica Imperialista. De la Doctrina de los dos Hemisferios a la Doctrina Imperial de George W. Bush*. Ediciones Zitra, Quito.

Ojasti, J. 1991. Human exploitation of capybaras, pp. 236–252. In: J.G. Robinson and K.H. Redford (eds.), *Tropical Wildlife Use and Conservation*. University of Chicago Press, Chicago, Illinois.

Pearce, D., N. Adger, D. Maddison, and D. Moran. 1995. Debt and the environment. *Scientific American* 272:52–56.

Perkins, J. 2004. *Confessions of an Economic Hit Man*. Berret-Koehler Publisher Inc., San Francisco.

Rich, B. 1994. *Mortgaging the Earth: The World Bank, Environmental Impoverishment and the Crisis of Development*. Earthscan, London.

Rivas, J.A. 2000. Life history of the Green Anaconda with emphasis on its reproductive biology, p. 364. In: *Ecology and Evolutionary Biology*. University of Tennessee, Knoxville.

Rivas, J.A. and G.M. Burghardt. 2001. Sexual size dimorphism in snakes: Wearing the snake's shoes. *Animal Behaviour* 62:F1–F6.

Rivas, J.A., M. d. C. Muñoz, G.M. Burghardt, and J.B. Thorbjarnarson. 2007a. Mating system and sexual size dimorphism of the Green Anaconda (*Eunectes murinus*). *In:* R.W. Henderson and R. Powell (eds.), *Biology of the Boas and Pythons*. Eagle Mountain Publishing Company, Eagle Mountain, Utah.

Rivas, J.A., M. d. C. Muñoz, J.B. Thorbjarnarson, G.M. Burghardt, W. Holmstrom, and P. Calle. 2007b. Natural history of the Green Anaconda (*Eunectes murinus*) in the Venezuelan llanos. In: R.W. Henderson and R. Powell (eds.), *Biology of the Boas and Pythons*. Eagle Mountain Publishing Company, Eagle Mountain, Utah.

Rivas, J.A., R.Y. Owens, and P.P. Calle. 2001. *Eunectes murinus*: Juvenile predation. *Herpetological Review* 32:107–108.

Rivas, J.A., J.V. Rodriguez, and C.G. Mittermeier. 2002. The llanos, pp. 265–273. In: R. Mittermeier (ed.), *Wilderness*. Cemex, México.

Rivas, J.A., J.B. Thorbjarnarson, R.Y. Owens, and M. d. C. Muñoz. 1999. *Eunectes murinus*: Caiman predation. *Herpetological Review* 30:101.

Robinson, J.G. 1993. The limits of caring: Sustainable living and the loss of biodiversity. *Conservation Biology* 7:20–28.

Robinson, J.G. and K.H. Redford (eds.). 1991. *Neotropical Wildlife Use and Conservation*. University of Chicago Press, Chicago, Illinois.

Rodríguez, J.P. and F. Rojas-Suarez. 1996. Guidelines for the design of conservation strategies for the animals of Venezuela. *Conservation Biology* 10:1245–1252.

Shaw, J.H. 1991. The outlook for sustainable harvest of wildlife in Latin America, pp. 24–36. In: J.G. Robinson and K.H. Redford (eds.), *Tropical Wildlife Use and Conservation*. University of Chicago Press, Chicago, Illinois.

Shine, R.G., Ambariyanto, P.S. Harlow, and Mumpuni. 1999. Reticulated Python in Sumatra: Biology, harvesting and sustainability. *Biological Conservation* 87:349–357.

Silva, J.L. and S.D. Strahl. 1991. Subsistence hunting, pp. 37–52. In: J.G. Robinson and K.H. Redford (eds.), *Tropical Wildlife Use and Conservation*. University of Chicago Press, Chicago, Illinois.

Snow, R.W., K.L. Krysko, K.M. Enge, L. Oberhofer, A. Warren-Bradley, and L. Wilkins. 2007. Introduced populations of *Boa constrictor* (Boidae) and *Python molurus bivittatus* (Pythonidae) in southern Florida. In: R.W.

Henderson and R. Powell (eds.), *Biology of the Boas and Pythons*. Eagle Mountain Publishing Company, Eagle Mountain, Utah.

Struhsaker, T.T. 1998. A biologist's perspective in the role of sustainable harvest in conservation. *Conservation Biology* 12:930–932.

Thorbjarnarson, J.B. 1999. Crocodile tears and skins: International trade, economic constraints and limits to sustainable use of crocodilians. *Conservation Biology* 13:465–470.

Thorbjarnarson, J.B., H. Messel, F.W. King, and J.P. Ross. 1992. *Crocodiles, An Action Plan for Their Conservation*. IUCN, Gland, Switzerland.

Thorbjarnarson, J.B. and A. Velasco. 1999. Economic incentives for management of Venezuelan caiman. *Conservation Biology* 13:397–406.

Vickers, W.T. 1991. Hunting yields and game composition over ten years in an Amazon Indian territory, pp. 53–81. In: J.G. Robinson and K.H. Redford (eds.), *Tropical Wildlife Use and Conservation*. University of Chicago Press, Chicago, Illinois.

Waller, T., P.A. Micucci, M. Mendez, and E. Alvarenga. 2007. The management and conservation biology of Yellow Anacondas (*Eunectes notaeus*) in Argentina. In: R.W. Henderson and R. Powell (eds.), *Biology of the Boas and Pythons*. Eagle Mountain Publishing Company, Eagle Mountain, Utah.

World Bank. 1992. *World Development Report*. Oxford University Press, New York.

World Bank. 2001. Adjustment lending retrospective: Final report operation policies and country services. World Bank, Washington, D.C. (http://siteresources.worldbank.org/Projects/Resources/ALR06_20_01.pdf).

Yunus, M. 1994. Preface: Redefining development, pp. ix–xii. In: K. Danaher (ed.), *50 Years Enough: The Case Against the World Bank and the International Monetary Fund*. South End Press, Boston, Massachusetts.

SPECIES PROFILE

Amazon Treeboa (*Corallus hortulanus*)

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The most geographically and ecologically widespread of the eight currently recognized species of the Neotropical treeboa genus *Corallus, C. hortulanus* ranges from Amazonian Colombia and Venezuela, through the Guianas, throughout Amazonian Brazil, Ecuador, Peru, and Bolivia, and south into Brazil's Atlantic Forest to about 26º 08' south latitude, and on Ilha Grande (off southeastern Brazil). It occurs in diverse habitats, including primary and secondary rainforest, mixed forest, second growth, palm forests, swamp forest, cerrado, caatinga (where it is probably confined to gallery forests), and savanna/grassland with stands of trees. It is often associated with edge situations and may be especially common in trees at the margins of bodies of water (rivers, lagoons, lakes). It also exploits heavily disturbed situations, such as fruit orchards (bananas, cacao), and will enter human edifices (outbuildings, homes), likely seeking shade, a diurnal retreat, or a human commensal rodent. Altitudinal distribution is from sea level to about 915 m, although it is uncommon above 300 m.

Few snake species worldwide can compete with *Corallus hortulanus* when it comes to variation in color and pattern. Dorsal ground color of the boas may be various shades of yellow, orange, gray, taupe, and/or brown. They may be virtually patternless yellow or orange, or have an ellipse-like shape that may be a shade of the ground color or in sharp contrast to it, or it may appear extremely mottled (but close inspection usually reveals the ellipse shape).

Amazon Treeboas are nocturnal and, as the name implies, largely arboreal. Their bodies are laterally compressed, and snakes may attain snout-vent lengths (SVL) over 1.6 m, and can reach SVLs of 1.8–1.9 m. Both active and ambush foraging strategies are employed, and the diet consists almost entirely of endotherms. When young (<750 mm SVL), birds (and, to a lesser degree, bats) comprise a significant portion of their diet (likely captured via active foraging while the birds are at roost) but, with increasing size, mammals (especially rodents) become their principal prey. Frogs and lizards are taken infrequently by *C. hortulanus*.

References

Henderson, R.W. 2002. *Neotropical Treeboas: Natural History of the* Corallus hortulanus *Complex*. Krieger Publishing Co., Malabar, Florida.

Pizzatto, L., O.A.V. Marques, and M. Martins. 2007. Ecomorphology of boine snakes, with emphasis on South American forms, pp. 35–48. In: R.W. Henderson and R. Powell (eds.), *Biology of the Boas and Pythons*. Eagle Mountain Publishing, Eagle Mountain, Utah.

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Although *Corallus hortulanus* demonstrates tremendous color and pattern variation throughout its range, this individual exhibits a much higher percentage of white scales than typically observed. It was captured in a small section of bamboo forest near the Rio Cristalino in northern Mato Grosso, Brazil. The habitat is transitional between southern Amazonian rainforest and the vast savanna-like Cerrado to the south. A second snake with similar coloration was found several days later. Whether these individuals are just variants of an extremely variable species or a color pattern anomaly is unknown.