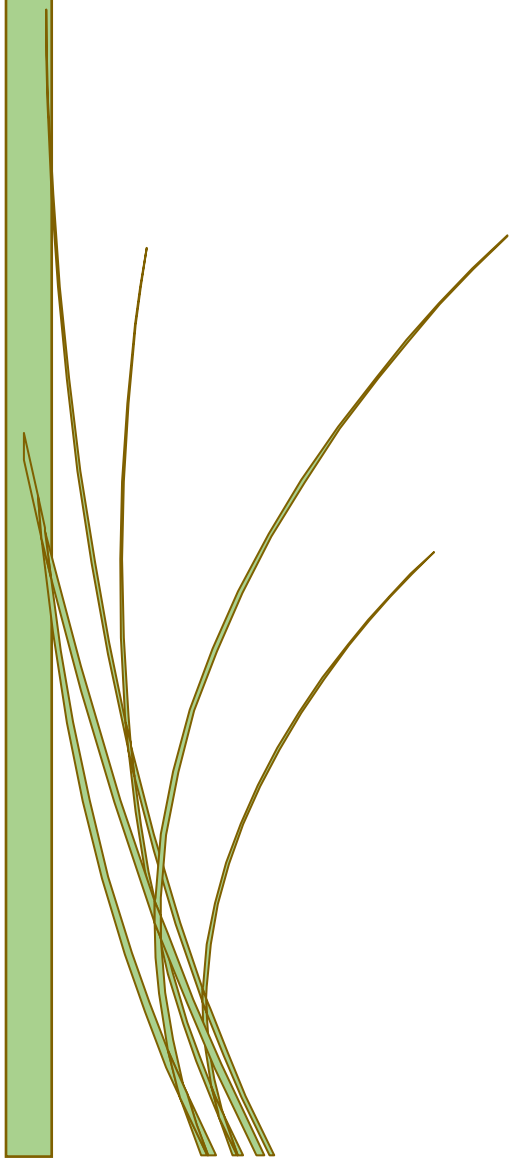
# Iguana Conservation

## What can be learned from other conservation efforts when protecting the Lesser Antillean Iguana *(Iguana delicatissima)*



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What can be learned from other conservation efforts when protecting the Lesser Antillean Iguana

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## Abstract

With a lot of threats facing the Lesser Antillean Iguana *(Iguana delicatissima)* on Sint Eustatius it is important to look at solutions that will work on the long term. Though the situation is different to that of other iguanas, it can be helpful and inspiring to look at conservation efforts done in the favour of other iguana species. Both the similarities and differences to the situation on Sint Eustatius could help in creating a plan that is sustainable for the parties involved and that will help to improve the situation of the Lesser Antillean Iguana on Sint Eustatius. In this case the situations of four different iguana species is specified along with the actions taken, the effects of these actions and a more current description of the situation. The situations compared to the situation of the Lesser Antillean Iguana show a striking similarity in some threats, similar threats crop up in almost all situations. There are some measures taken in most all of the situations, these measures are successful but call for some caution. These are general concerns that should be taken under consi deration whenever a conservation plan is written. This doesn't mean that these measures cannot be taken, it advises caution with these measures.

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# Introduction

The Lesser Antillean Iguana *(Iguana delicatissima)* is under threat; they have already disappeared on a number of islands of the Lesser Antilles and on the remaining islands the populations are being threatened by predation of non-native predators like dogs and cats, hybridization with the Common Green Iguana *(Iguana Iguana)* and habitat loss, habitat alteration or habitat fragmentation. (Breuil, 2010)

There are other Iguana species that have been, or still are, threatened by similar circumstances. There were conservation programs created for these Iguanas and their specific situations, but there are similarities to the situation of the Lesser Antillean Iguana. That means that the conservation efforts can be compared and learned from. This research will be a very general comparison of the differences and similarities of the situations of each different Iguana species and what conservation efforts were made and what the effect of these efforts was.

In order to give an advice to STENAPA the focus of the research will be in comparing the situations of each species to the population on St. Eustatius. The conservation efforts will be compared and the measures that could have the most success on St. Eustatius will be highlighted in an advice for STENAPA. This creates the following research question:

***What are the similarities and differences of other Iguana conservation efforts and what can STENAPA take away from these to protect the Lesser Antillean Iguana?***

To answer this question the following sub questions have been created:

**How are the situations of the other Iguanas different to each other and to the Lesser Antillean Iguana?**

**How are (were) the situations of the other Iguanas similar to each other and to the Lesser Antillean Iguana?**

**What measures were taken to protect the Iguanas and how could this be applied to St. Eustatius?**

**How effective were the measures and what will the effectiveness probably be for St. Eustatius?**

**What is the current situation of each Iguana species and what are the current conservation activities?**

The goal of this research is to provide an overview of different conservation efforts concerning Iguanas and which parts could be adjusted and applied to St. Eustatius to help protect the Lesser Antillean Iguana.

# Background

The Lesser Antillean Iguana population is in decline across the Lesser Antilles, the range was one thought to be from Anguilla all the way to Martinique. Now they have disappeared throughout a large part of that range; they are extirpated on St. Martin, Saba, Barbuda, St. Kitts, Nevis, Antigua, Montserrat and Marie-Gallante, where the Common Green Iguana was introduced. (Breuil, 2010)

## On Sint Eustatius

The population on St. Eustatius was thought to be large before the European colonization, the population is rapidly declining. A population size estimate was made in 1992; this estimated the population at around 300 individuals. When the population was re-estimated in 2000 the population was thought to be less than 300 animals. In 2004 the population was estimated to be between 275 and 650 individuals. More recent estimates put the population size at a few hundred individuals, meaning that the population size is not big enough for the required 5000 individuals for a viable population. (Breuil, 2010)

## Main threats

The main threats to the Lesser Antillean Iguana on St. Eustatius are hybridization, non-native predation, habitat loss, habitat alteration, habitat fragmentation, non-native browsing competitors and accidents.

Though only one Common Green Iguana was found on St. Eustatius and it was removed very quickly, some hybrids were seen. These were removed, but there is a high probability that there are some hybrids on the island still.

The predation, mainly by dogs, is an issue. Especially guard dogs that roam free in yards form a big risk to the iguanas that cross the yards to get to food sources or nesting sites. The young iguanas can be caught by cats.

Habitat loss and habitat fragmentation occur because of human activity, people building new houses and roads cause the habitat of the iguanas to shrink or fragment. Habitat alteration occurs through human activity like building houses and clearing yards, but roaming livestock also have an influence on this. Because these animals graze and browse they cause the vegetation to shift and alter, causing the food sources and habitat of the iguanas to change.

The iguanas can also get in accidents; when crossing roads they can be hit by traffic, they can get stuck in mesh fences and abandoned cisterns. (Ravon, 2015)

## Grand Cayman Blue Iguana

The Grand Cayman Blue Iguana *(Cyclura lewisi)* is an iguana that has been at the brink of extinction, the population was less than 25 individuals in 2002. It was listed as Critically Endangered and it has been through extensive actions that the population is growing. At this moment it is listed as Endangered on the IUCN Red List, after the assessment in 2012. (Burton, 2012)

### Ex situ captive breeding

A number of zoos worked on getting captive bred animals around 1990 to ensure a captive population whose genetic flow could be carefully managed. There was a problem with this however, there was some hybridization going on in this captive population. The hybrids were removed from the population, but the remaining population was very small. With only three males and one female this was a very limited start of a captive breeding program, when a more extensive genetic analysis was done it became known that these four individuals were all descendants of one pair of iguanas. (Hudson, 1996)

### In situ captive breeding and head-starting

A captive breeding program combined with a head starting facility was started on the Grand Cayman to try to save this species of iguanas. The goal of this was to increase the number of iguanas from as many founders as possible and to use the progeny of these animals to start subpopulations in managed and protected natural areas. (BIRP, 2017)

### Protected areas and habitat

These protected areas do have some problems, because the arrival of humans has changed a lot of the islands natural habitats. Most of these changes are not beneficial to the Blue Iguanas, the ones that cause most of the issues facing the iguanas are deforestation and abandoned farmland, where non-native pasture grass casts shades on the soil surface and the roots create matts that deter the iguanas.

Conservation of the habitats is difficult, mostly because there are a lot of different influences which can determine the success of the protection. Most of these influences again, stem from human sources. Political involvement and local support are important factors besides the large amount of money needed. (BIRP, 2017)

### Blue Iguana Recovery Program

The goal of the Blue Iguana Recovery Program is to have 1000 Iguanas in the wild in protected areas. A self-sustaining and free-roaming population, reproducing and evolving naturally with their natural environment. This does mean that the living environment of these iguanas will have to be monitored, managed and protected to ensure that the iguanas will keep a suitable place to live. This requires a lot of effort and support, including commercial products to help boost economic resources. (BIRP, 2017)

### Current situation

The situation at this moment is looking better, with over 400 individuals now living in protected areas and almost 200 individuals being raised in a head-starting facility until they are big enough for release. The expectation is that within three generations the population will be able to rise to a 1000 individuals. This from both the captive breeding and head-starting and from natural reproduction in the population living in the wild. (Burton, 2012)

## Fiji Crested Iguana

The Fiji Crested Iguana *(Brachylophus vitiensis)* is marked as Critically Endangered on the IUCN Red list, mainly because the populations on all but one or two islands are barely detectable. This means that with population surveys in those areas very few iguanas are found. Those populations might become functionally extinct within a few years if no action is taken. The population is estimated to have declined somewhere around 80% in a matter of 40 years. (Harlow, 2012)

### Threats

The things that pose the biggest threat to these iguanas is the habitat loss caused by human development, goats and alien plants. This is causing the dry forest to be altered and to disappear. The other important threat is that this is a small iguana, that along all age classes is threatened by feral cats and possibly rats. The example of this is Deviulau Island, where a large portion of the land is suitable for iguanas to live, yet it is very likely that the population remains small because of the predation by cats. On other islands the treat may come from the introduced mongoose and conversion of land for plantations or urbanization. (Harlow, 2012)

### Green Iguana

Recently the Common Green Iguana *(Iguana iguana)* is also found in Fiji, but the exact effects this has on the Fiji Crested Iguana is unknown so far. However the effects this iguana has on the environments where it is introduced has been documented in other places where it is now found. This species may cause the Fiji Crested Iguana to have a lesser chance at having a sufficient territory to survive. Even if that were not the case the introduction of the Common Green Iguana is causing confusion in the education programs, which have their aim in protecting the local iguana while also focussing on eradicating the Common Green Iguana. (Harlow, 2012)

### Conservation actions

A captive breeding program was started and in 2015 the first of the captive bred and head-started iguanas were released on Monuriki. The iguanas that were head-started all came from the captive breeding program, as there is not a lot known about these iguanas and they are so hard to find in their natural habitat. On the island Monuriki extensive work had been done to remove the goats and rats from the island and through that the habitat where the new iguanas were to be released. This process had started in 2011, where along with removing the invasive species intensive work to improve the quality of the habitat has been done. The removal of the goats and rats already shows a significant improvement of the habitat, where young trees and shrubs are beginning to emerge and more bird species are seen and are having success at nesting on the island. Similar actions are being taken for other islands. (Kiukula, 2015)

### Current situation

At this moment the population still is in decline, but because of extensive actions the expectation is that this will change over the course of a few decades. In a lot of places the natural habitat is regenerated through the removal of goats and threats from non-native predators are greatly reduced as well. This means that along with captive breeding and head-starting the population will be able to grow on its own, reducing the need for human interference in their reproduction. (Harlow, 2012)

## Jamaican Iguana

The Jamaican Iguana *(Cyclura collei)* was thought to be extinct, but in 1970 one was found and again in 1990. The species was rediscovered in the Hellshire Hills in this way and the Jamaican Iguana Research and Conservation Group (JIRCG) was formed shortly after the rediscovery. This group is now called the Jamaican Iguana Recovery Group (JIRG). (Grant, 2010)

### Threats

The Jamaican Iguana faces a lot of threats, mostly because of ongoing human actions like charcoal burning and limestone mining. The latter is not happening on a big scale, but if that were to happen to facilitate the expansion of human settlement it could become a problem. Tourism and invasive species like mongoose, cats, dogs and possibly feral pigs also put pressure on the continued survival of this iguana species. (Grant, 2010)

### Conservation Actions

There were a lot of very intensive conservation actions needed to get this iguana back from the brink of extinction. The most important was the mitigation of the threat that the invasive species form, mostly the predatory species like the mongoose, cats and dogs. To deal with the mongoose and cats a series of traps for these animals were set in the core area where the iguanas live. In a little over four years more than 400 mongoose were trapped and in addition to that a number of 33 cats and 53 pigs were caught and removed. (Wilson, 2014)

### Headstarting

To ensure more recruitment into adulthood a head-starting program was started. For this program hatchlings that emerge from nests are captured and brought to Hope Zoo for the head-starting. In 2013 there were more than 200 young head-started iguanas released over the course of 7 years. At the 2013 nesting season a number of 53 iguanas were spotted depositing eggs and 320 hatchlings caught and processed after hatching. (Wilson, 2014)

### Protection of nesting sites

The nesting sites are monitored in the nesting period, mid-May through to mid-June. At the start of August enclosures are erected around these nesting sites, they are then checked two to three times each day to process all hatchlings found within the enclosure. These hatchlings are weighed, measured, blood samples are taken and they are given a PIT tag. This is done throughout the whole hatching season from mid-August to mid-September. After they were processed they were released outside the enclosure. The trapping of the invasive species and the human presence near the hatching sites were protecting the nesting sites significantly in comparison to the situation before the program started. The population estimates are largely derived from the amount of females nesting at the communal nesting areas, so when this has increased by 6 times from the amount that was seen nesting there in 1991 it means that the population has grown significantly since the program began. (Wilson, 2014)

### Current situation

At this moment the population appears to be recovering, but this iguana is still Critically Endangered. The adult population is somewhere between 100 and 200 individuals, the head-started animals are growing into the population properly and have been observed nesting. It is unknown however if there are any individuals outside of the invasive species traps where they would still be preyed upon by these invasive species. Also the treats from the charcoal burning and invasive species are not fully disappeared or decreased enough to ensure that the population will be able to recover on its own. (Grant, 2010)

## Mona Rhinoceros Iguana

The Mona Rhinoceros Iguana *(Cyclura cornuta stejnegeri)* is only found on Mona Island between Puerto Rico and Hispaniola, in a deep sea channel known as the Mona Passage. The submarine banks show no evidence of a (former) connection to either Puerto Rico or Hispaniola. The whole 11 by 7 kilometre island is home to this specific iguana. (Garcia M. P., 2000)

### Threats

The main threats for the Mona Ground Iguana are habitat alteration by goats and a scarcity of juveniles. The latter is very likely to be caused by pigs eating the eggs and cats predating the hatchlings. Also the fact that the island is a popular destination for recreational activities such as camping, exploring and hunting. Most of these activities take place in sinkhole depressions along the coast, coincidentally these areas are very important nesting areas for these iguanas. The iguanas are wary and easily disturbed when they are nesting and these activities can disturb the females while they lay their eggs, another problem with this is that the activity can cause the nests to be damaged, resulting in smaller numbers of hatchlings emerging from the nest or nests not hatching at all. (Garcia M. P., 2000)

### Head-starting

The head-starting facility has reared more than 300 individuals in fourteen years. The young iguanas were released when they had a Snout-Vent length of at least 22,5 centimetres, because at that length they would very likely be too big for cats to predate them. (Garcia M. &., 2016)

### Actions taken

The conservation actions are mainly focussed on creating a larger adult population, but also on getting control of the two non-native species that are impacting the population growth most; the pigs and the cats. It is thought that fully removing these from the island is not feasible, though the pigs are being hunted to control the size of the population. (Pérez-Buitrago N. G., 2008)

As Mona Island is part of the Puerto Rico commonwealth the Puerto Rico Department of Natural Resources and the Environment (PR-DNRE) has taken some protective measures, such as moving the hunting season to a time outside of the nesting season of the iguanas. Also there are fences placed around critical iguana habitats and nesting areas, the iguanas can move through these fences easily, whereas pigs and goats are unable to pass through. This happened in 1982. Though official studies have to be done to be sure of the success of this it is thought to be successful as there are more hatchlings emerging from the areas that have been fenced off from pigs. (Pérez-Buitrago N. S., 2016)

### Effectiveness actions

At this moment there is no more recent population review than the year 2000. This is a long time ago and a more recent review could give some insight to the effectiveness of the conservation actions taken. However independent researches have seen two females from the head-starting facility were seen at nesting sites during the nesting season and the population does seem to have a more even age spread than it did before. (Pérez-Buitrago N. S., 2016)

So the measures taken do appear to have some effect, this does mean that these should be continued and additional measures should be taken to lessen the need of the head-starting facility. This means that the pigs and cats should be eradicated from the island, plans for doing that are being made. (Pérez-Buitrago N. G., 2008)

## General Concerns

### Invasive species

The removal of the invasive species would be the best conservation tool, but it is not used often because it can be technically difficult and expensive. Invasive species eradication are a long term project and are not a fast remedy, just as these are not always singularly successful as the species to be protected by this might need more than just the removal of the invasive species.

As an intermediate tool a head-starting program can be used to successfully decrease population declines and even to start population recovery. But it should never be used as the only conservation tool. (Pérez-Buitrago N. G., 2008)

### Head-starting

The main issue with head-starting is that the survival rates over the long term are not yet widely researched. The released individuals may not behave the same as wild animals and in that way have smaller chance of success, mainly in predator avoiding, foraging for food and reproductive success. A general lack of data on long term success calls for more research and should call for care before starting such a program. Also they are not addressing the causes of decline in a species. (Pérez-Buitrago N. S., 2016)

### Captive Breeding

Captive breeding is another tool that should not be used as the main conservation tool but can be used especially when the population is severely fragmented and genetic diversity is at risk. It does still mean that other conservation actions should be taken to ensure that captive bred individuals are released into a wild situation where chances at survival are sufficient to ensure these individuals can add to natural reproduction and the genetic strength of the wild population. (Leus, 2013)

## Comparing situations

The situations of all iguanas are different, but some parallels can be drawn between the species and the situations.

The Fiji Crested iguana is an iguana with a very similar lifestyle to the Lesser Antillean Iguana, this means that they have the same difficulties when trees and shrubs are grazed away by non-native grazers like goats and cows. When human agricultural practices reduce the amount of land that is suitable even more this can ensure that the habitat of the iguanas is reduced to a point where it is very hard for these animals to maintain a sufficient territory.

The situation of the Jamaican Iguana is similar mostly with the extreme amount of human influences that so directly threaten the iguanas. Though at first this species was thought to be extinct it became clear that development plans would threaten the habitat of the newly rediscovered iguana. The invasive predators were largely responsible for the very low recruitment into adulthood. And though extensive measures have been taken to limit this impact it is still unclear if the Jamaican Iguana has a chance outside the circle of predator traps that protect the core habitat where most iguanas live.

While the situation in the case of the Grand Cayman Blue Iguana was more to get as much public involvement as possible, the situation for this species was very dire. Not only because there were so few animals left, but also because most of the habitat of these animals had disappeared because of human actions. Public and political involvement was a critical step to ensure the protection of this species.

The Mona Rhinoceros Iguana finds a similarity with the Lesser Antillean Iguana mostly in the way that the juvenile animals are very likely to be predated on by cats and rats, while goats degrade the natural habitat of the iguana. Something that is probably not a major threat on Sint Eustatius is nests being plundered by feral pigs.

## Conclusion & Recommendation

After the comparison of the situation it becomes very clear that iguana conservation is a multifaceted dilemma, the most important factors are the habitat protection and animal protection. The habitat must be protected to ensure suitable size and quality to support the iguanas and the animals must be protected from factors that would create trouble for them not only to survive but also to reproduce. Therefor the most important conservation tools are the removal of non-native species that would degrade the habitat or predate on the animals.

In the case of Sint Eustatius this should mostly be focussed on removing the non-native grazes like goats, cows and sheep from the island. If not remove them from the island, working at making sure that these animals are kept in pastures and not left to roam the island. For this a lot of cooperation with the government is critical, this to ensure that proper legislation is in place. Also the government would be able to help enforce this legislation. With the roaming livestock under control the plants and trees would get a chance to recover and new sprouts will have a chance to grow into plants and trees that will provide food and shelter to the iguanas.

The non-native predators are an important part as well, luckily Sint Eustatius has no mongoose, which has in other places hunted the Lesser Antillean Iguana and has also posed a major threat to other iguana species. But cats and dogs do still pose a threat to these iguanas. Feral cats and dogs could be caught and a way to deal with the animals caught should be worked out with the government. Cats and dogs kept by people pose a different situation all together, as this requires the cooperation of the owners to try to mitigate the effect these animals could have on the iguanas crossing the yards and the hatchlings that could be caught by the cat that they let roam.As rats can pose a problem to hatchlings and iguana nests working on a way to significantly decrease their population is important, but as most people are generally not very fond of rats the chance of local cooperation is big. Though this would still depend on the amount of effort it would take.

As hybridization with the Common Green Iguana is also occurring on the island an important part is to ensure this cannot get a real foothold on the island. An important part of this is to ensure that no more Common Green Iguanas get on the island, this calls for training and cooperation of all the staff working at the harbour and airport. Regular work to find hybrids is an important part, but finding nesting sites in and in a large area around the hotspots would also help. In this way the hatchlings could be caught when they emerge and any hatchlings that are hybrids can be kept and euthanized while pure local iguanas can be released around that nesting area. Any hatchlings with uncertain lineage can be kept until DNA analysis are done and then either be euthanized or released. This measure would also protect nesting sites from cats and rats, so in this way the emerging hatchlings can be kept a little safer during one of the most vulnerable stages in their lives.

Head-starting and captive breeding could help to boost population numbers, but the effectiveness of this will be limited if the habitats of these animals do not increase in size and quality. Though the predation of cats would be limited when the iguanas are big enough before they are released, some thought should be given to when the animals will be released. As a debate could be had over age or size, most programs however release the iguanas when they reach a certain size as opposed to a certain age to ensure they are large enough to be left alone by most predators.

All the mentioned actions are extensive and could be quite expensive. Working together with the right people and organizations would help a great deal in ensuring success. Though all conservation actions are long term projects their effects will also be on a longer term, ensuring that the conservation is more successful than it would be with short term solutions and short term success.

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