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## The Amazon Rainforest: Threats and Restoration

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# The Amazon Rainforest: Threats and Restoration

## **Introduction**

Ecuador is home to many of the world's most diverse ecosystems. To the east there is the Galapagos Islands, in the heart of the main land there are cloud forests, and to the west there is the Amazon rainforest. This paper will focus on the biodiversity of the Amazon Rainforest as well as threats to the area, conservation and restoration. Many species depend on the rainforest for food and shelter. It is up to humans to maintain and protect these areas because without them, species and homes will be lost.

## **The Amazon Rainforest**

The Amazon Rainforest has 5% of the entire world's biodiversity in a very small fraction of the Earth's land area (Bare and Tello, 2010). The rainforest is essentially a drainage basin for the Amazon River. The water has accumulated and provides the area with the opportunity to be lush and green all year round. There are four layers that make up the rainforest: the emergent layer, the canopy, the understory and the forest floor (Amazon Rainforest, 2003). Each layer is made up of different plants and contains different species. This is what makes this area so diverse. The different layers provide varying ecosystems for many species. The emergent layer is made up of the tallest trees in the ecosystem. They reach far beyond the height of the canopy layer. The majority of the trees in this layer are evergreens; broad-leaf hardwoods that are 200 feet tall and 16 feet wide. Since they are exposed to the elements, they have evolved to have winged seeds that can be easily taken up by the wind and spread throughout the area. The next layer is the canopy layer. This is where some believe half of the entire world's species

live (Amazon Rainforest, 2003). The canopy blocks most of the sunlight from getting to the layer below. The leaves on the trees in this layer are shaped to allow water to flow downward to prevent the growth of moss and other lichens. Other leaves allow the formation of small pools that provide drinking water for wildlife. Since the canopy filters most of the sunlight, only 2-5% makes its way to the understory. The plant species here are greatly dependent on the large insect population and animals in order to pollinate. The trees have large leaves that are a dark green color and the height never reaches above twelve feet. Lastly, the forest floor layer. This layer is primarily the decomposition layer. Leaves that fall from above land here and break down in a matter of six weeks to provide nutrient for the roots that tend to stay towards the surface.

## **Biodiversity of the Amazon**

The vastly different ecosystem within each layer provide resources for many different species. The variety of wildlife that live here ranges from mammal to insects. There are at least 500 mammals living amongst a plethora of reptiles, lizards and birds. About 33% of the world's bird population lives in the Amazon but there are still many species that have yet to be discovered (Amazon Rainforest, 2003).

Humans almost always like to see a beautiful Macaw at a bird show. There is something so interesting and intriguing about a large, brightly colored bird that one does not see every day. Macaws can be found in the Amazon Rainforest. There are many different species, blue-and-yellow macaw, and the scarlet macaw to name a few. The blue-and-yellow macaw had ones been extinct due to human impact, whether it be from hunting or loss of habitat. Jaguars are another species that have been impacted by habitat

fragmentation. They prowl through the understory and along the riverside. They need large, continuous plots of land, which is why habitat loss impacts them so greatly. Right now Jaguar populations have the potential of decreasing in the near future. In Yasuni National Park there population is thought to be abundant (Mittmann, 2014). This may change if oil-drilling beings, causing their habitat will be altered. Yasuni National Park and oil drilling will be discussed more in depth later on in this paper.

Within the canopy and understory there are many species of tree frog living in the Amazon Rainforest. Tree frogs do not get their name because they live in trees, but because they have the ability to climb up them (Leviticus, n.d.). Some tree frogs found in the Amazon Rainforest are poisonous. One is able to tell this because they tend to be brightly colored to warn predators that they should not be eaten. The poison dart frog is one that does just that. There are different species, which makes the coloring vary. The yellow-banded poisonous dart frog secretes poisonous toxins from its skin that it quickly consumed by any predator that dare try and eat them. These species are also in danger of loosing their habitat due to humans.

## **Habitat fragmentation and Oil-drilling**

Nearly all the species living in the Amazon Rainforest are heavily impacted by habitat loss and fragmentation. This is one of the major threats to the Amazon as a whole. Humans typically cause habitat fragmentation. Roads, oil drilling, and deforestation for cattle ranching all cause the demise of this beautiful and much needed ecosystem.

Oil drilling and roads in the Amazon are directly linked to one another. In 1972 the first oil pipeline was placed in the ground of the Amazon Rainforest (Widener, 2007). In order to get the equipment needed to install and build the compounds to extract the oil, roads were needed. When roads started being build people started to come and inhabit the area surrounding the roads known as the Oriente. This lead to what is known as the fishbone effect where there is one main branch (the back bone) and several smaller roads branding off the main road (All Roads Lead to Oil, 2015). When building a road forest needs to be cleared in order for materials to be put down to make a proper road. Right away habitat becomes lost. Since roads are typically not short, a decent amount of habitat is lost and patches are created. Roads break up the habitat causing fragmentation to happen and for many species this alters their migration and travel patterns on a daily basis. Habitat fragmentation and deforestation lead to the decline of the healthy, abundant ecosystem and can cause a collapse in the primary productivity (Bonilla-Bedoya et.al.,2014). It has been found that close proximity to a road impacts wildlife negatively (Whitworth et. al, 2015). The most obvious threat coming from roads is collisions with wildlife. Everywhere in the world there is the possibility of colliding with a wild animal on the road. In the rainforest however, there are endangered and threatened species that have the potential of being killed. In Andrew Whitworth's paper, he and his co-authors found that butterfly and bird species populations were rather unaffected by roads while amphibian and understory bird species populations decreased as you got closer to the road (Whitworth et. al, 2015). This shows that roads are impacting many species within the different ecosystems of the Amazon Rainforest.

Oil drilling has been a major threat to this area. Not only because in order to create drilling sites deforestation needs to occur but because of the process and careless actions of some oil companies. Texaco was an oil company that was allowed access into the oil that was in the Amazon Basin of Ecuador. Texaco is currently owned by Chevron. The issue with this oil drilling and production process is that they did not correctly go about lining the pits where the oil would be sitting which is known as crude oil. The process of oil production includes injecting produced water back into the ground where oil was taken from. In the case of Texaco, this wastewater was not injected back into the ground. Instead there were pipes installed that now allowed the toxic water to flow into the natural waterways of the Amazon. This has severely impacted both the wildlife and indigenous people in the area. All of the indigenous tribes living in the Amazon depend on the waterways to obtain fish, drinking water, cooking water and bathing water. They use the waterways as their people historically have. Now there has been consequences to doing things as their tribes traditionally have. The water is contaminated with toxins coming directly from the Texaco oil production pits. This has caused cancer, death, increased miscarriages in women in close proximity to the contaminated water, increased cases of headaches, and other ailments (San Sebastian, 2004). Oil has gotten into the systems of many wildlife species and they are dying as a result. Wildlife cannot speak for itself but humans can. In 1993 the indigenous people sued Chevron because of their many ailments and health issues that have resulted from their actions (Kimberling, 2006).

The outcome of this lawsuit was that Chevron now has to remediate the areas around their oil pits. But they have only worked and remediated a small fraction of their oil pits. Their work has not been enough. Because of their oil production tribes have

been forced from their homes and moved because their areas are no longer inhabitable. They deserve to have their homes restored and so does the rainforest. In the latest ruling the money Chevron is due to owe the indigenous has been severely cut and will never be enough. (Texaco/Chevron, n.d). All of the contaminates need to be taken out of the soil and water if possible. Once this is done the ecosystem and all its inhabitants have a chance to try and start their lives over in a healthy way. But, removing the oil is not going to be the only solution. The habitat needs to be fully recovered in order for wildlife to thrive in those areas once again.

Yasuni National Park is currently sitting on top of the second largest un-tapped oil reserve in the world (Bass et. al, 2010). Many see drilling for oil in this area as a positive for Ecuador as a whole. Oil is one of the top exports for the country and is how most people make their money. If it were not for oil, Ecuador would be in a worse financial state than it already is. Oil production has been occurring in this national park for many years but now they are looking to drill within the buffer zone. If they take away the buffer zone how will wildlife ever be truly protected? Since roads already exist in this section of the Amazon Rainforest there has been an increase in hunting that has now become overhunting of some species and illegal logging (Bass et. al, 2014). Again this all leads to fragmentation and alteration of habitat. If this habitat is lost or degraded in anyway, threatened species in the area are expected to be cut in half and become endangered (Bass et. al, 2014). The threatened species alone should be a reason to alter oil-drilling plans in Yasuni National Park.

## Climate Change

Climate change is directly linked to human activity. Increased greenhouse gases trap infrared radiation from the sun, which warms the atmosphere causing increases in temperatures. Forests all over the world are important in fighting climate change. The air we breathe is a result of trees. Because trees absorb more carbon than they release, they forests are carbon sinks. A carbon sink is a collection of carbon in some sort of reservoir. When trees are cut down carbon is released into the atmosphere and there is less carbon being absorbed in the area. This is why deforestation and clear cutting increases climate change. The ever-rising temperatures near and in the rainforest are starting to result in changes with carbon sequestration and storage. Rising air temperatures means rising ocean temperatures. Warming ocean water will begin to dry out the basin, dryer forests mean frequent forest fire which both will cause a flux in the emitted carbon (Amazon Watch, 2015).

There was an experiment done by Daniel Napstad to see how far the rainforest could be pushed in drought conditions. In order to create drought like conditions a large trench was dug encompassing the entire study area. This was dug in order to prevent rainwater from seeping into the study area. Near the forest floor plastic cut outs were capturing and detouring 80% of the rainfall to the wooden cutters that drove the water into the trenches. In the beginning the rainforest was reacting the way the researchers thought it would. The roots began to absorb water from further depths while photosynthesis is slowed. As an adaptation to the lack of rainfall and available water in the soil, leaves themselves started absorbing the rainfall directly before it made it to the plastic panels. But none-the-less the trees were beginning to die and were not able to

store the same amount of carbon as before. They were beginning to emit more than they absorbed from the atmosphere. Severe drought conditions over large periods of time will push the Amazon Rainforest to its breaking point and there will be no saving it.

(Stokstad, 2005).

## **Conservation and Education**

When creating management plans for wildlife it is especially important to take into account their home range and migration patterns. If these are not thought of carefully the probability of a species population increasing is very minimal. Protected areas, large patches of continuous habitat are an important part of conservation and managing wildlife. A way of ensuring protected land in the Amazon has been mandatory private forest reserves that occupy 80% of the private land (Negroes et. al, 2010). This ensures protected land on every piece of private land that will be preserved. It is and should not only be up to the governments to be protecting wildlife and the rainforest. Education is a key factor in conservation. If there is knowledge about endangered species and how to properly manage them, their populations may have a chance to increase. Deforestation for oil-drilling and cattle farms has been seen as negative for the environment. Once the forest has been cut down and not properly managed to sustain the set back in succession the soil will become degraded and unable to ever grow trees once more. Cattle ranching is a large market in many parts of the Amazon Rainforest because other countries are willing to buy their meat. People must understand that there are more sustainable practices and places to raise cattle other than in a system that the entire world

depends on. Through education programs there is a chance to decrease some human cause biodiversity and habitat loss in the Amazon Rainforest.

## **Restoration of the Amazon Rainforest**

Conservation and education, for the most part, focus on the wildlife living within the rainforest. Restoration is the process of returning the rainforest to a previous state or in some cases making it entirely better. Deforestation can be a positive impact on the ecosystem and wildlife. Fires and deforestation set back the successional stages of the forest, which can improve soil where they have been degraded as well as increase, forage for wildlife. This of course is a practice of silviculture (controlling the health and quality of a forest) that has to be managed properly. Regardless of the positive impacts, deforestation cannot happen in too many places or in large patches because it can easily become a negative influence on its surroundings.

One way to restore the rainforest is to plant trees. This will start the regeneration of an area where habitat has been lost. In order to do this there have been planting methods that have been more successful than other. In an experiment done to find cost-effective ways to restore the rainforest, they found that using an auger versus using a spade had no effect on the survival rate of the seedling. The auger however, is more time consuming and expensive in the long run. For many areas this may be the limiting factor in restoring an area. If the method is low cost then there may be an increase in the decision to do so. They also found that their plots over previous cattle run areas had great succession rates with an average of 91% survival (Preece et. al, 2013). This may be the most effective way to restore a plot of land back to being part of the rainforest. In some

areas the soil may need to be restored. Soils can become degraded and unsuitable for growing trees. Rehabilitation and fertilization of those soils will return them to the luscious soil needed for growth (Bare & Tello, 2010). When soils are restored and trees begin to grow, insect species will increase which will also increase species that depend on insects to survive. Over time the areas will not need to be looked after, or tended too because the plants will be able to regenerate and succeed on their own. This is the ultimate goal of any restoration project and hopefully one day the Amazon Rainforest will not need our help in maintaining its health and rich biodiversity.

## **Conclusion**

Perhaps there is a chance to save the Amazon Rainforest through conservation and restoration. Some threats to this area cannot be stopped but we as humans have the ability to slow down those processes. It is extremely important to look at what we are doing to the Earth and recognize that we are the cause to many of our own problems. The Amazon Rainforest is home to so many species and beautiful wildlife that future generations deserve to witness. Management takes time but we have that time and need to use it wisely to protect the beauty that supplies us with the world as we know it.





Figures 2 and 3: Left: The yellow-banded poison dart frog; Right: The blue-and-yellow macaw



Figure 4: An oil-drilling site in the Amazon Rainforest.



Figure 5: Daniel Napstad amongst the plastic panels of his drought experiment.

## Proportion of Brazilian Amazon forest contained in Brazil's protected areas network



mongabay.com, using Nepstad 2009, Butler 2009

Figure 6: Two graphs of the results of the mandatory protected private land project in Brazil.



Figure 7: Planting new trees to start regeneration; restoration project.

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