

# Nano-satellite impact on Bolivian Society

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## Abstract

As natural disasters impact our environment, more efficient monitoring is required in order to approach preventive and corrective activities. Observation and monitoring through nano-satellites have been shown to be an efficient technology to monitor local areas and allow experts to know the status of important natural areas. However, this technology is not extended in some developing countries as it involves relatively high expense budgets and specific training. Sadly, most natural areas that should be supervised are in such countries, therefore, actions to stabilize our environment cannot be performed.

## Introduction

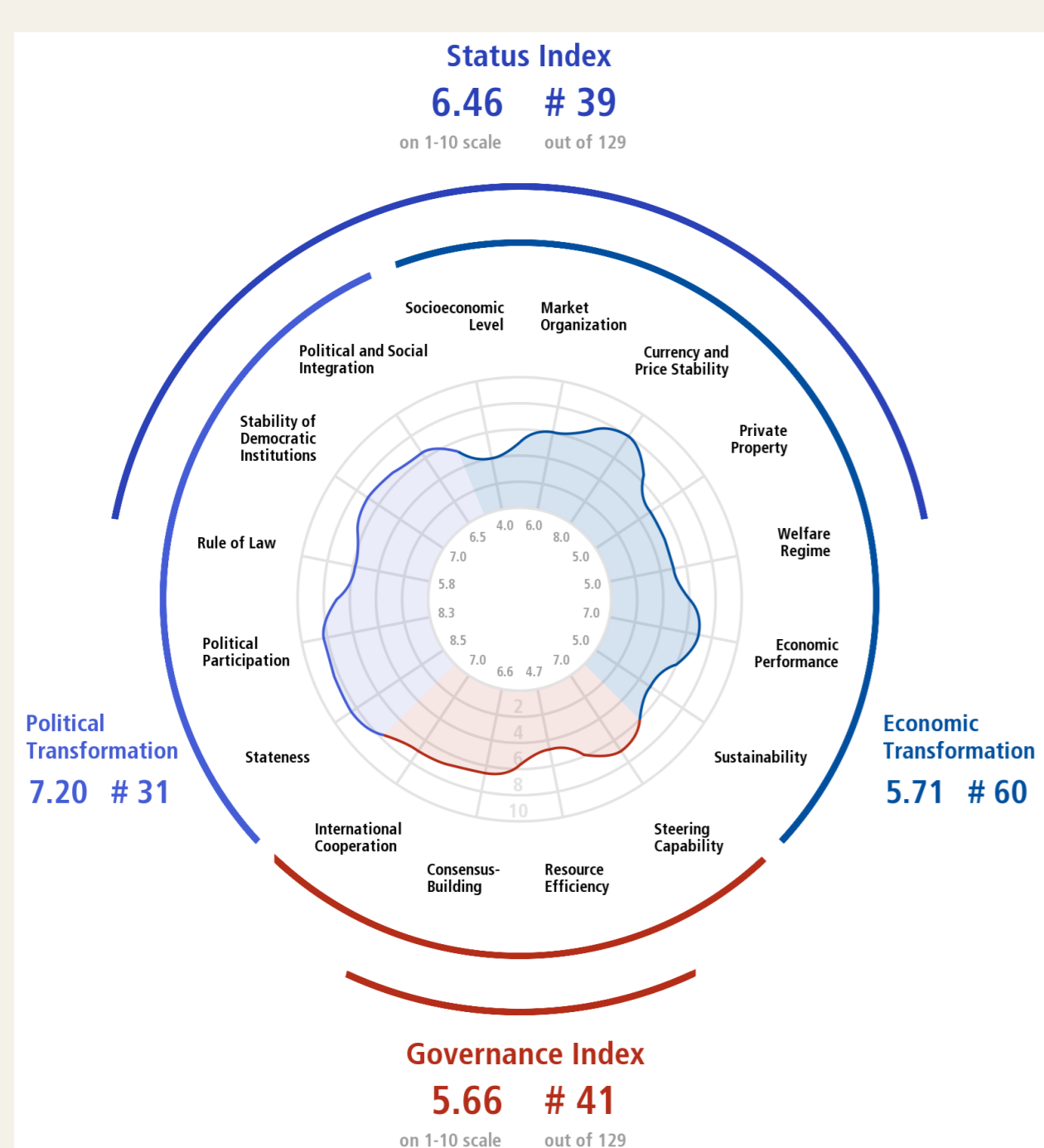
Recently, the Amazon has been exposed to wildfires in more than 900.000 hectares due to slash-and-burn farming, these events exposed the lack of necessary equipment for rainforest observation. Bolivia has been exposed to satellite technology through the acquisition of TKSAT-1, a telecommunications satellite which is used to connect rural and small communities away from urban areas. Unfortunately, high expenses were needed to train engineers in aerospace sciences besides the maintenance and operational costs. Therefore, it's very difficult to put an observation satellite in orbit.

In fact, Bolivia requires formal education programs to train aerospace engineers as most Bolivians who are involved in aerospace or any related topics studied abroad and trained by themselves. These programs should be ideally accessible and affordable, nevertheless, public policy prioritizes other issues, such as primary education, illiteracy diminish, security, etc., as a result of these facts, space programs are almost null in Bolivia. There is a limited number of people in who are trying to dabble in nano-satellites. Although the creation of Bolivian Space Agency (ABE) took place, the opportunity to be part of a specialized team even though being a professional with studies in space related technology, is very small.

There is vast state of art regarding nano-satellite technology used in Earth observation, but the lack of educational programs is a considerable limit. The understanding of nano-satellite's impact in our economy and natural resources monitoring is not yet possible.

## Political Impact

In Bolivia, politics have played an important role in the preservation of rainforests and other natural resources, therefore nano-satellites will affect the course of politics.



(Figure 1)

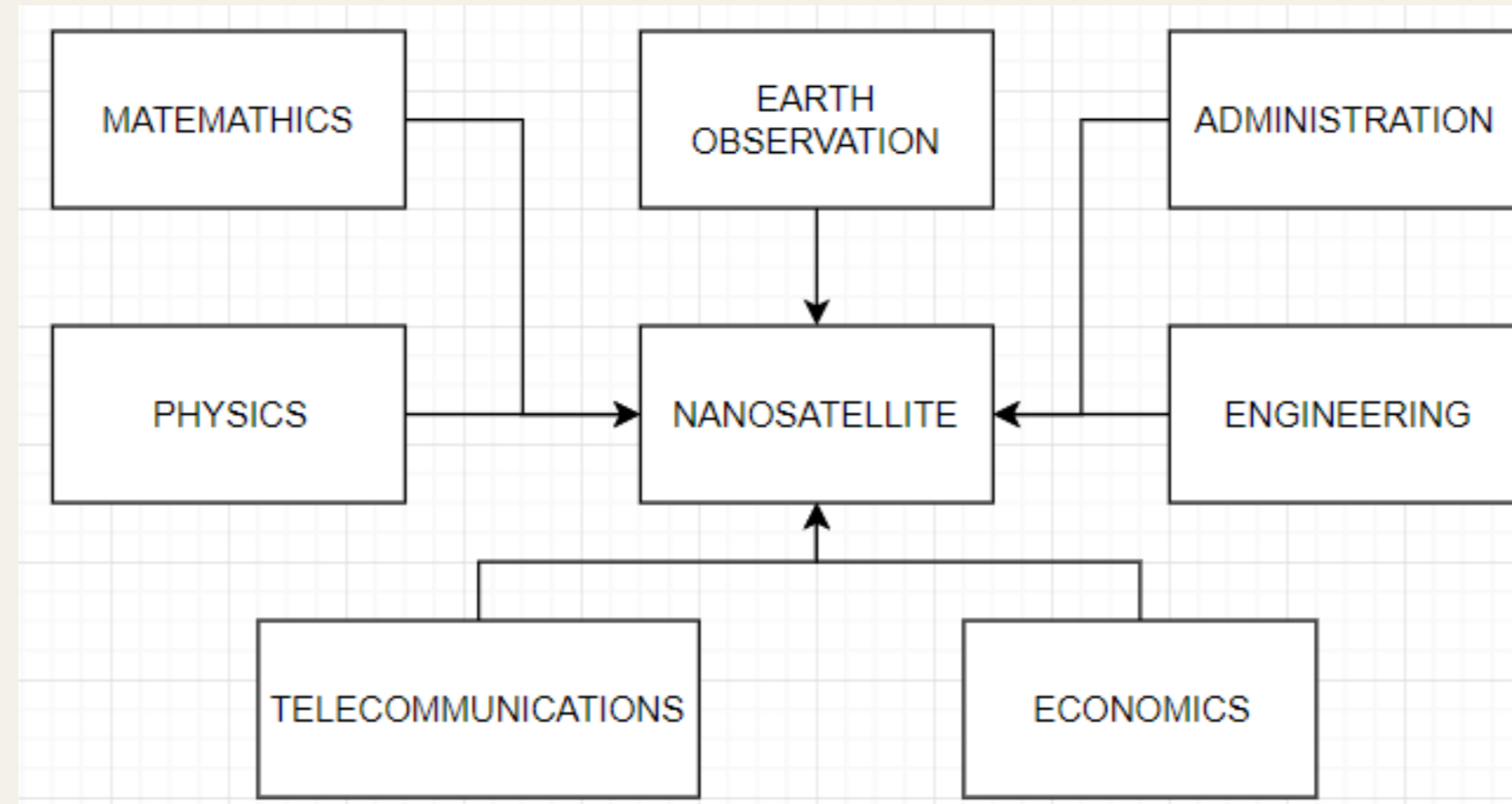
## Economical Impact

The first satellite acquired by Bolivia cost more than 300M USD, this amount is not affordable by actual Bolivian economy model, therefore, nano-satellites would be an affordable solution.

Class	Cost	Mass
Large satellite	\$ > 100 M	> 1000 kg
Small Satellite	\$50 - 100 M	500 - 1000 kg
Mini-satellite	\$ 5 - 20 M	100 - 500 kg
Micro-satellite	\$ 2 - 3 M	10 - 100 kg
Nano-satellite	\$ < 1 M	< 10 kg

## Educational Impact

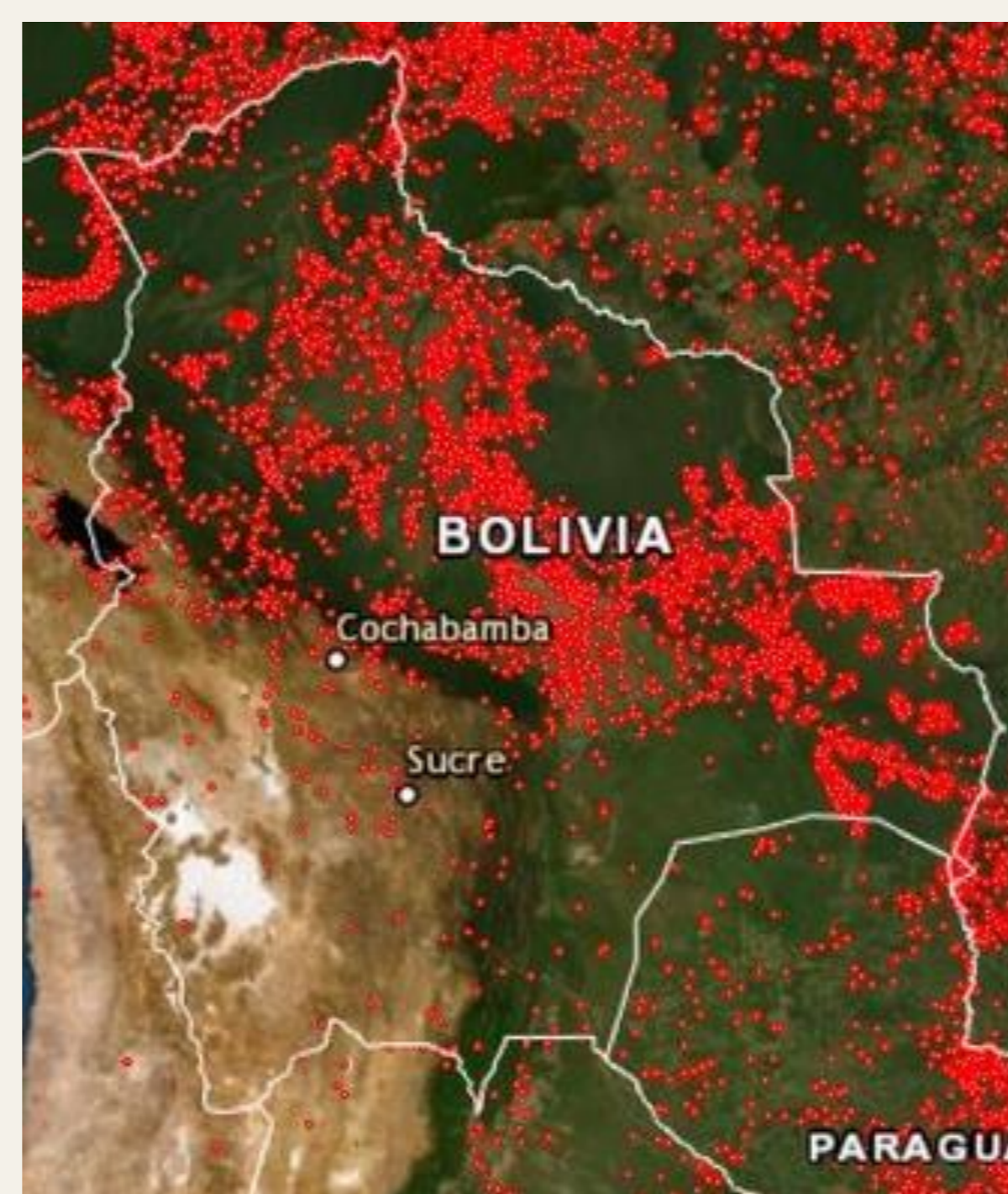
Nano-satellites are a multidisciplinary fundamental part of teaching not only engineering but also disciplines such as economics and business administration. This would lead our educational programs to be competitive in a technology-evolving-environment.



(Figure 2)

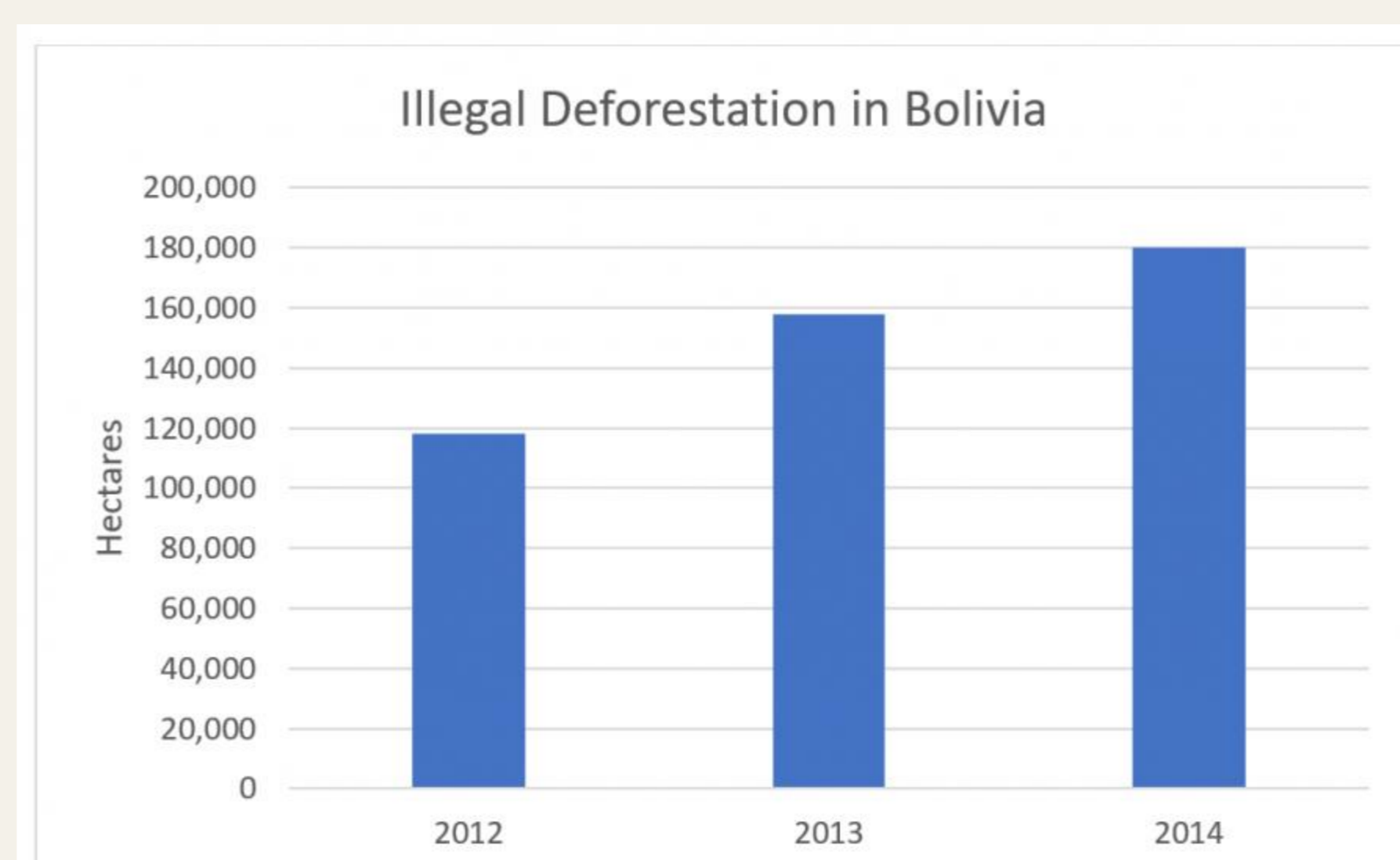
## Environmental Impact

According to NASA Satellites images, the fire spots present in Bolivian region were alarming, the rainforest health must be monitored by Bolivian government in the future. In 2019, almost 2 million hectares were destroyed due to wildfires.



(Figure 3)

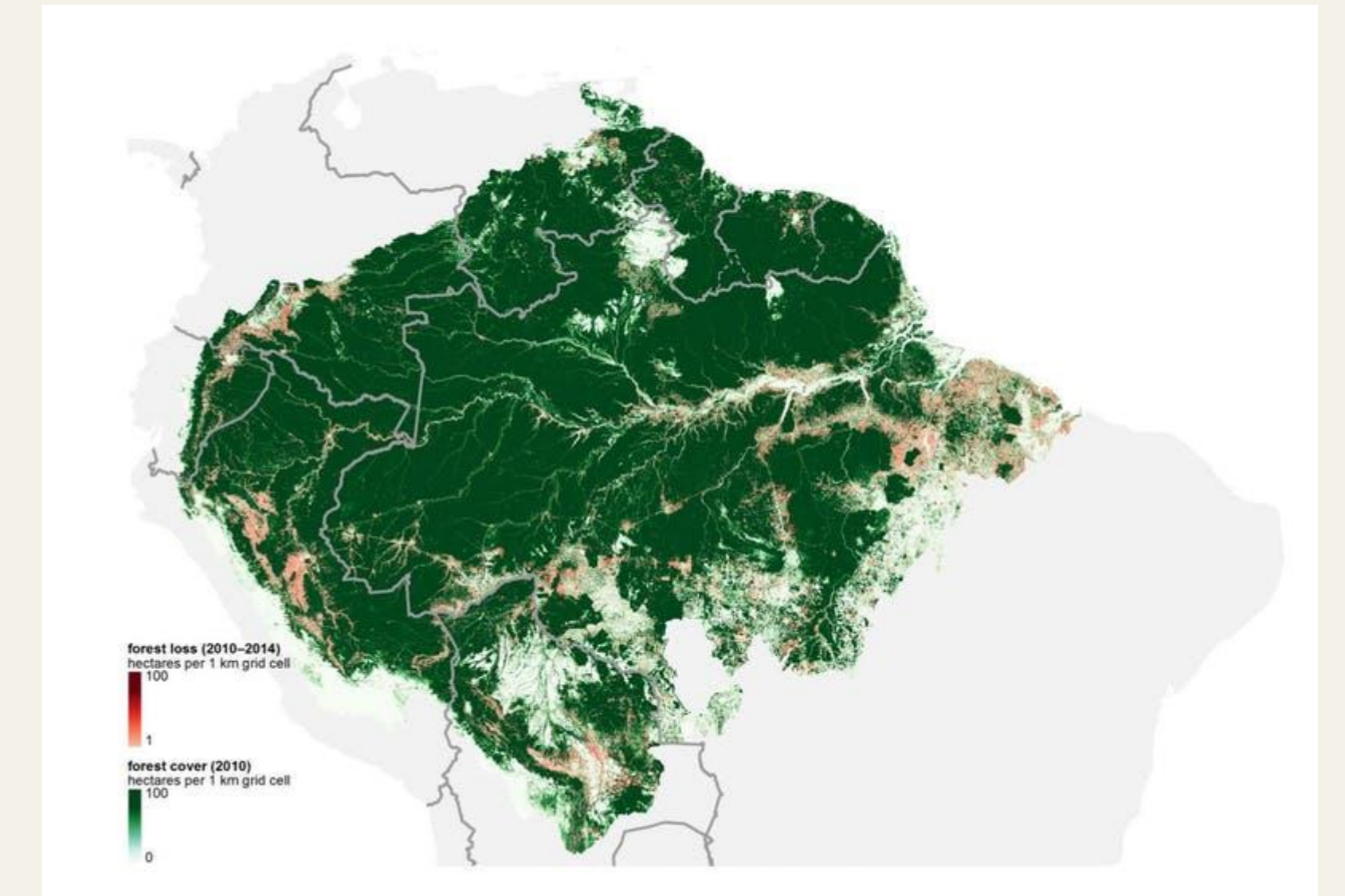
On the other hand, illegal deforestation has been a problem since long ago in the South American region, in Bolivia specifically, this illegal activity increased in the past decade.



(Figure 4)

## Environmental Impact

There were several proposals for environment protection laws, protests and international observers to stop deforestation, but Bolivia's north is part of Amazon (approximately 22.2 millions of hectares) which represents a very difficult area to observe making use of conventional technologies.



(Figure 5)

## Conclusions

To conclude, Nano-satellites will bring controversy to actual politics regarding investment and monopoly rupture. Many Bolivian companies depend on foreign telecommunication, earth observation and technology companies, this fact would dramatically change if Nano-satellite technology is brought.

Nano-satellites could be the best option to start understanding satellite concepts and prepare future engineers in the development and deployment of these low-cost spacecraft. Therefore, the inclusion of nano-satellites to our society will create more competitive educational programs.

It's of high importance to include under-developed countries in the space community, as most of them possess very important natural resources like the Amazon, that need continuous observation on water level, biomass growth and other important variables to track changes as time goes by.

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