

Earth's Balance: Analyzing Forest Cover in Municipalities and Cities in Negros Oriental

DOI: 10.5281/zenodo.18522626

Piolo M. Omaña

Tanjay City Science High School, Tanjay City Division, Negros Oriental, Philippines

Ruth Ann A. Dagatan

Tanjay City Science High School, Tanjay City Division, Negros Oriental, Philippines

Reign Jane Shaleigh T. Salva

Tanjay City Science High School, Tanjay City Division, Negros Oriental, Philippines

Abstract

This study was conducted to analyze changes in forest cover in the municipalities and cities of Negros Oriental, with a focus on the different types of forests, including open forests, closed forests, and mangrove forests. Data was collected and meticulously calculated using a specific formula to derive meaningful results. The findings revealed that Santa Catalina experienced the most significant loss of forest cover, while Tanjay City showed the most substantial gain in forest cover. Interestingly, it was observed that closed forests and mangrove forests gained area over the past decade, whereas open forests experienced a decrease in area. These results have shed light on the importance of focusing efforts on increasing the forest areas of Negros Oriental. This study aims to utilize these valuable findings to develop strategies that will contribute to the enhancement of forest cover in Negros Oriental, ultimately leading to a more sustainable and ecologically balanced future.

Keywords: Forest cover, Open Forest, Closed Forest, Mangrove Forest, Negros Oriental, Reforestation

Introduction

Negros Oriental, a province in the Negros Island Region (NIR), is known for its rich biodiversity and unique natural landscapes. Historical accounts from ELTI at Yale University (n.d.) describe Negros Island as once being covered with biodiverse dipterocarp forests where tall hardwood trees sheltered rare endemic species and supported the daily needs of local communities. Over the years, however, the province has faced increasing environmental pressures. Like many areas in the Philippines, Negros Oriental continues to experience forest cover loss caused by human activities and land conversion, which has led to a range of ecological and social concerns.

Forest cover loss affects the environment, biodiversity, and the communities that depend on natural resources. When forests disappear, wildlife habitats are destroyed, biodiversity declines, and the air becomes more polluted because fewer trees absorb greenhouse gases. The loss of trees also weakens soil, leading to erosion, reduced farmland, and sedimentation in rivers. These environmental changes harm industries such as agriculture, tourism, and forestry, and they disrupt the livelihoods and cultural practices of many communities. Addressing forest cover loss is essential to protect biodiversity, reduce climate risks, and support the people and economies that rely on healthy forest ecosystems.

This study aims to examine the current state of forest cover in Negros Oriental by identifying which municipality or city has the lowest remaining forest area, determining which types of forests are declining, and analyzing changes in forest cover between 2010 and 2015 and between 2015 and 2020. Understanding these patterns is important for guiding conservation efforts and supporting sustainable land management. By highlighting the importance of forest ecosystems and the consequences of their decline, this research emphasizes the need to protect Negros Oriental's natural resources to support biodiversity, reduce climate risks, and safeguard the communities that depend on them.

Forest cover loss endangers wildlife by destroying habitats and lowering biodiversity. It also increases greenhouse gas emissions by destroying trees that absorb air pollution exacerbating climate change. The absence of trees causes soil erosion, resulting in the loss of arable land. Agriculture, tourism, and forestry are all experiencing severe economic losses. Furthermore, many communities rely on trees for their livelihoods and culture, and destruction can uproot people and disturb their way of life.

The objective of this research is to:

1. Identify the municipality or city in Negros Oriental with the lowest forest cover.
2. Find out what type of forest is declining
 - 2.1 Open Forest
 - 2.2 Closed Forest
 - 2.3 Mangrove Forest
3. Identify the changes of area of forest cover in Negros Oriental
 - 3.1 2010 to 2015
 - 3.2 2015 to 2020

Literature Review

The island of Negros in the Philippines was famous in colonial times for its biodiverse dipterocarp forests, where towering hardwoods sheltered rare endemic animals and provided important ecosystem services to its residents. But over the last 150 years, the primary forest cover of the island has been decimated due to logging, sugar cane plantations, and agriculture (ELTI – Yale University,n.d).

According to the Global Forest Watch (2024), from 2002 to 2023, Negros Oriental lost 115 ha of humid primary forest, making up 1.4% of its total tree cover loss in the same time period. The total area of humid primary forest in Negros Oriental decreased by 1.4% in this time period.

In Negros Oriental, as of 2010, the top 7 regions represent 55% of all tree cover. Santa Catalina had the most tree cover at 28.0 kha compared to an average of 7.47 kha (Global Forest Watch, 2024).

“We strongly support [Negros Oriental’s] vision for environmental conservation and sustainability, and we are ready to help you turn this vision into reality,” said UNDP Philippines Resident Representative Ramachandran (UNDP, 2023).

The BINHI arboretum project is part of the university’s biodiversity conservation efforts to protect endemic plant species in Negros Oriental. According to Dr. Betty McCann (Siliman University President), “We would like to plant more of them (native trees), and there is a need for an arboretum that has a nursery so that once we plant the first set of trees, we will have some replacement,” (Partlow, 2024).

Mindoro lost more than 200,000 hectares of forest cover from 2003 to 2015, and Palawan nearly 30,000 hectares during the same period. These cases reflect a broader pattern of deforestation also affecting Negros Oriental. (Ilagan, 2021). This relates to our research showing that the problem is not only present in Negros Oriental.

According to the Climate Change Commission (2024), as of 2022, Philippine Forestry Statistics, it is estimated that the country has a total forest cover of 7.22 million hectares or 24.07% of the country's land mass, which is "way below" the 17.8 million hectares worth of forest cover we had back in 1934. This showcases just how much of our forest we have lost over the years, and how serious a threat deforestation is to the country.

Methodology

Understanding forest cover change is important for knowing the health and stability of our ecosystems. As forests continue to face pressure from human activities, we need clear and reliable methods to study how these areas change over time. This methodology explains the steps, tools, and data used to examine forest cover change in Negros Oriental.

Independent variable:

- Area of Closed Forest (2010, 2015, 2020)
- Area of Open Forest (2010, 2015, 2020)
- Area of Mangrove Forest (2010, 2015, 2020)
- Forest Cover loss of municipalities and cities of Negros Oriental
- Forest Cover gain of Municipalities and cities of Negros Oriental

Dependent variable:

- Total forest cover change in Negros Oriental
- Change of area in Closed Forest (2010 – 2015) (2015 – 2020)
- Change of area in Open Forest (2010 – 2015) (2015 – 2020)
- Change of area in Mangrove Forest (2010 – 2015) (2015 – 2020)
- Changes in Forests Covers in municipalities and cities of Negros Oriental

B. Materials

Philippines Forestry Statistics
Negros Oriental Deforestation Rates and Statistics

C. Procedure

Understanding forest cover change is essential to assess the health, stability, and sustainability of our terrestrial ecosystems. As forests continue to face the pressure of human activities, it becomes increasingly important to employ systematic and reliable methods to document how these landscapes evolve over time. This procedure outlines the specific steps undertaken to analyze forest cover change in Negros Oriental, ensuring that data collection, image processing, classification, and validation are carried out with accuracy and consistency.

1. Obtain the data about the forest cover in Negros Oriental, including the forest cover loss and gain in its municipalities and cities.
2. Calculate the data using the formula created by the researchers
3. Get the result of the changes in forest covers of the municipalities and cities then arrange it in descending order.
4. Obtain another set of data about the areas of covered forest, open forests, and mangrove forests in Negros Oriental.
5. Calculate the data using the formula created by the researchers

6. Get the result of the changes of the Open forests, Closed forests, and Mangrove forests in and arrange them in ascending order.
7. Calculate the changes in forest cover in Negros Oriental from 2010 to 2015 and from 2015 to 2020 using the results of the changes in the Open forests, Closed forests, and Mangrove forests

Conceptual Framework

This study follows an Input–Process–Output (IPO) framework to determine the changes in forest cover across the municipalities and cities of Negros Oriental. The inputs include the tree cover loss and tree cover gain for each locality, as well as the recorded areas of closed forests, open forests, and mangrove forests for the years 2010, 2015, and 2020. The process involves collecting these datasets, computing the changes using formulas such as $CFC = L - G$ for overall forest cover change, ($CFC_{15-10} = R_{2015} - R_{2010}$, $CFC_{20-15} = R_{2020} - R_{2015}$) for Closed forest cover changes from 2010-2015, 2015-2020, ($OFC_{15-10} = S_{2015} - S_{2010}$, $OFC_{20-15} = S_{2020} - S_{2015}$) for Open forest cover changes from 2010-2015, 2015-2020, and ($MFC_{15-10} = P_{2015} - P_{2010}$, $MFC_{20-15} = P_{2020} - P_{2015}$) for Mangrove forest cover changes from 2010-2015, 2015-2020. These computations allow the researchers to determine increases or decreases in forest area over time. The outputs of the framework are the ranked changes in forest cover per municipality or city and the quantified shifts in closed, open, and mangrove forest areas, which together provide a comprehensive picture of forest cover dynamics in Negros Oriental.

Results

The changes in forest cover in the municipalities and cities of Negros Oriental are represented by the equation:

$$C = L - G$$

Where,

C = Change of forest cover (gain or loss)

L = Tree cover loss

G = Tree cover gain

Therefore,

Ex.

Santa Catalina tree cover loss = 983 ha

Santa Catalina tree cover gain = 301 ha

$$C = 983 - 301$$

$$C = 684 \text{ ha}$$

Table 1. Changes of area of the forest covers of municipalities and cities in Negros Oriental

Municipality/City	Formula	Area
Sta. Catalina	983 ha – 301 ha	682 ha
Mabinay	650 ha – 73 ha	577 ha
Sibulan	625 ha – 71 ha	554 ha
Siaton	612 ha – 64 ha	548 ha
Guihulngan	681 ha – 256 ha	425 ha
Bindoy	529 ha – 133 ha	396 ha

Valencia	410 ha – 21 ha	389 ha
Pamplona	530 ha – 158 ha	372 ha
Bais City	420 ha – 133 ha	287 ha
Jimalalud	225 ha – 64 ha	161 ha
Bayawan City	706 ha – 546 ha	160 ha
Amlan	158 ha – 31 ha	127 ha
Dauin	209 ha – 95 ha	114 ha
Zamboanguita	150 ha – 40 ha	110 ha
Tayasan	186 ha – 110 ha	76 ha
Bacong	87 ha – 14 ha	73 ha
La Libertad	170 ha – 106 ha	64 ha
Vallehermoso	94 ha – 36 ha	58 ha
Canla-on City	99 ha – 46 ha	53 ha
Manjuyod	106 ha – 60 ha	46 ha
Dumaguete	54 ha – 11 ha	43 ha
Ayungon	308 ha – 272 ha	36 ha
San jose	57 ha – 32 ha	25 ha
Basay	411 ha – 390 ha	21 ha
Tanjay City	223 ha – 239 ha	-16 ha

The changes in area in the closed forest from 2010 to 2015 are represented with the equation:

$$CFC_{15-10} = R_{2015} - R_{2010}$$

Where,

CFC_{15-10} = Changes of Area in Closed Forests from 2010 to 2015

R_{2015} = Area of closed forests in 2015

R_{2010} = Area of closed forests in 2010

Therefore,

Area of closed forests in 2015 = 4,226 ha

Area of closed forests in 2010 = 2,741 ha

$$CFC_{15-10} = 4,226 \text{ ha} - 2,741 \text{ ha}$$

$$CFC_{15-10} = 1,485 \text{ ha}$$

The changes in area in the Closed Forest from 2015 to 2020 are represented with the equation:

$$CFC_{20-15} = R_{2020} - R_{2015}$$

Where,

CFC_{20-15} = Changes of Area in Closed Forests from 2015 - 2020

R_{2015} = Area of closed forests in 2015

R_{2020} = Area of closed forests in 2020

Therefore,

Area of closed forests in 2020 = 7,648 ha

Area of closed forests in 2015 = 4,226 ha

$CFC_{20-15} = 7,648 \text{ ha} - 4,226 \text{ ha}$

$CFC_{20-15} = 3,422 \text{ ha}$

The changes in area in the open forest from 2010 to 2015 are represented by the equation:

$$OFC_{15-10} = S_{2015} - S_{2010}$$

Where,

OFC_{15-10} = Changes of Area in Open Forests from 2010 to 2015

S_{2015} = Area of open forests in 2015

S_{2010} = area of open forests in 2010

Therefore,

Area of open forests in 2015 = 31,972 ha

Area of open forests in 2010 = 22,074 ha

$OFC_{15-10} = 31,972 \text{ ha} - 22,074 \text{ ha}$

$OFC_{15-10} = 9898 \text{ ha}$

The changes in area in the Open Forest from 2015 to 2020 are represented by the equation:

$$OFC_{20-15} = S_{2020} - S_{2015}$$

Where,

OFC_{20-15} = Changes of Area in Open Forests from 2015 to 2020

S_{2015} = Area of open forests in 2015

S_{2020} = Area of open forests in 2020

Therefore,

Area of open forests in 2020 = 28,339 ha

Area of open forests in 2015 = 31,972 ha

$OFC_{20-15} = 28,339 \text{ ha} - 31,972 \text{ ha}$

$OFC_{20-15} = -3633 \text{ ha}$

The changes in area in the Mangrove Forest from 2010 to 2015 are represented by the equation:

$$MFC_{15-10} = P_{2015} - P_{2010}$$

Where,

MFC_{15-10} = Changes of Area in Mangrove Forests from 2010 to 2015

P_{2015} = Area of mangrove forests in 2015

P_{2010} = Area of mangrove forests in 2010

Therefore,

Area of mangrove forests in 2015 = 1510 ha

Area of mangrove forests in 2010 = 1051 ha

$MFC_{15-10} = 1510 \text{ ha} - 1051 \text{ ha}$

$MFC_{15-10} = 459 \text{ ha}$

The changes in area in Mangrove Forest from 2015 to 2020 is represented with the equation:

$$MFC_{20-15} = P_{2020} - P_{2015}$$

Where,

MFC_{20-15} = Changes of Area in Mangrove Forests from 2015 to 2020

P_{2015} = Area of mangrove forests in 2015

P_{2020} = Area of mangrove forests in 2020

Therefore,

Area of mangrove forests in 2020 = 1576 ha

Area of mangrove forests in 2015 = 1510 ha

$MFC_{20-15} = 1576 \text{ ha} - 1510 \text{ ha}$

$MFC_{20-15} = 66 \text{ ha}$

Table 2. Changes of Area in Closed Forests

Year	Formula	Area
2010 - 2015	4,226 ha – 2,741 ha	1,485 ha
2015 - 2020	7,648 ha – 4,226 ha	3,422 ha

Table 2.1 Changes of Area in Open Forests

Year	Formula	Area
2010 - 2015	31,972 ha – 22,074 ha	9,898 ha
2015 - 2020	28,339 ha – 31972 ha	-3,633 ha

Table 2.2 Changes of Area in Mangrove Forests

Year	Formula	Area
2010 - 2015	1510 ha – 1051 ha	459 ha
2015 - 2020	1576 ha – 1510 ha	66 ha

Discussion

The results of the study show clear differences in how forest cover has changed across Negros Oriental. Sta. Catalina recorded the highest forest cover loss, with a decrease of 682 hectares, indicating that its forested areas are under heavy pressure. In contrast, Tanjay City posted the highest gain at 16 hectares, suggesting that some parts of the province are experiencing improvements in forest conditions. These opposite trends highlight how uneven forest changes are across municipalities.

When the changes were examined by forest type, the period from 2010 to 2015 showed a notable increase of 11,842 hectares of forest cover in the province. Most of this growth came from open forests, which expanded by 9,898 hectares. Closed forests also increased by 1,485 hectares, while mangrove forests grew by 459 hectares. This suggests that during this period, forest regeneration, whether natural or supported by local initiatives, was relatively strong.

However, the pattern shifted from 2015 to 2020. Closed forests continued to grow by 3,422 hectares, and mangrove forests increased by 66 hectares, but open forests declined sharply by 3,633 hectares. Because of this drop, the province recorded an overall loss of 145 hectares during this period. The decline in open forests is concerning because these areas are often the first to be affected by agricultural expansion, land conversion, and illegal logging.

These findings reflect the broader situation described in the literature. Ilagan (2021) reported massive forest losses in Mindoro and Palawan due to similar pressures, showing that Negros Oriental is not isolated from the nationwide pattern of deforestation. The Climate Change Commission also noted the drastic reduction of forest cover in the Philippines over the decades, which supports the idea that the province's forest decline is part of a larger environmental issue. On the other hand, statements from UNDP Philippines and local advocates like Dr. Betty McCann highlight ongoing efforts to restore forests through tree planting and nursery development. The increases in closed and mangrove forests in the province may be early signs of these efforts taking effect, although the decline in open forests shows that more work is needed.

Overall, the study's findings confirm what many national and regional reports have already pointed out: forest recovery is possible, but it is uneven and easily reversed. Negros Oriental shows both progress and setbacks, making it clear that conservation strategies must be strengthened and tailored to the specific needs of each forest type, especially open forests, which remain the most vulnerable.

Conclusion

This study showed that forest cover in Negros Oriental has changed in many different ways over the years. Sta. Catalina lost the most forest area, while Tanjay City gained the most. From 2010 to 2015, the province gained a large amount of forest cover, but from 2015 to 2020, the forest cover started to decrease again because open forests went down. Closed forests and mangrove forests continued to grow, but the loss of open forests caused an overall drop in forest cover.

These results match what other studies have found in different parts of the Philippines, where forests continue to shrink because of farming, land use changes, and illegal cutting of trees. At the same time, some efforts to protect and plant trees are helping certain forest areas recover. Overall, the study shows that Negros Oriental needs stronger and more focused actions to protect its forests, especially open forests, so the province can keep its natural resources healthy for the future.

Based on these findings, the province can use this data to guide better solutions. Areas with high forest loss, such as Sta. Catalina, should be prioritized for stricter monitoring, reforestation, and community-based protection programs. Forest areas that are under pressure need targeted interventions like controlled land-use planning, stronger enforcement against illegal cutting, and support for sustainable and responsible land practices. The growth in closed and mangrove forests also shows that restoration efforts can work, so expanding tree-planting programs, improving nursery development, and involving local communities can help strengthen these gains. By using the data to identify where losses are happening and which areas need the most attention, decision-makers can create more effective and long-lasting strategies to protect Negros Oriental's forests.

References

Climate Change Commission. (2024, March 21). *Keeping up with deforestation*. Retrieved January 2, 2025, from

<https://climate.gov.ph/news/851>

DENR (n.d.). *Philippine Forestry Statistics*. Forest Management Bureau. Retrieved September 21, 2024, from

<https://drive.google.com/file/d/1QRuOBAMt9GoN7xNxgw0WBYO-eFUu59hG/preview>

DENR (n.d.). *Philippine Forestry Statistics*. Forest Management Bureau. Retrieved September 21, 2024, from

<https://drive.google.com/file/d/1cN1IL2MaB-Y1V8OEEkmJohup0xJ3Crh6/preview>

DENR (n.d.). *Philippine Forestry Statistics*. Forest Management Bureau. Retrieved September 21, 2024, from

https://drive.google.com/file/d/1aGMhI3ifAVawnC4CReUcJhj_knnlifu/preview

ELTI (n.d.). *Restoring the Rich Forests of Negros Island in the Philippines*. Yale SCHOOL OF THE ENVIRONMENT. Retrieved September 21, 2024, from

<https://elti.yale.edu/our-stories/restoring-rich-forests-negros-island-philippines>

Global Forests Watch (n.d.). *Negros Oriental, Philippines Deforestation Rates & Statistics*. Retrieved September 21, 2024, from

<https://www.globalforestwatch.org/dashboards/country/PHL/52/?location=WyJjb3VudHJ5IiwieUEhMIiwNTiIXQ%3D%3D>

Global Forests Watch (n.d.). *Negros Oriental, Philippines Deforestation Rates & Statistics*. Retrieved September 21, 2024, from

<https://www.globalforestwatch.org/dashboards/country/PHL/52/?category=land-cover&location=WyJjb3VudHJ5IiwieUEhMIiwNTiIXQ%3D%3D>

Global Forests Watch (n.d.). *Negros Oriental, Philippines Deforestation Rates & Statistics*. Retrieved September 21, 2024, from

<https://www.globalforestwatch.org/dashboards/country/PHL/52/?category=forest-change&location=WyJjb3VudHJ5IiwieUEhMIiwNTiIXQ%3D%3D>

Ilagan, K. (n.d.). *7M hectares of Philippine land are forested — and that's bad news*. Philippine Institute for Development Studies. Retrieved January 2, 2025, from

<https://www.pids.gov.ph/details/7m-hectares-of-philippine-land-are-forested-and-that-s-bad-news>

Partlow, M. J. (2024, September 4). Garden in Negros Oriental to host endangered PH tree species. Philippine News Agency. Retrieved January 2, 2025, from

<https://www.pna.gov.ph/articles/1232648>

United Nations Development Programme. (2023, September 20). *Finance for nature is underway for Negros Oriental*. Retrieved January 2, 2025, from

<https://www.undp.org/philippines/press-releases/finance-nature-underway-negros-oriental>