

Report for Forest Query into Global Deforestation, 1990 to 2016

Forest Query is on a mission to combat deforestation around the world and to raise awareness about this topic and its impact on the environment. The data analysis team at Forest Query has obtained data from the World Bank that includes forest area and total land area by country and year from 1990 to 2016, as well as a table of countries and the regions to which they belong.

The data analysis team has used SQL to bring these tables together and to query them in an effort to find areas of concern as well as areas that present an opportunity to learn from successes.

1. GLOBAL SITUATION

According to the World Bank, the total forest area of the world was **41282694.9 sq km** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9 sq km** a loss of 1324449, or **3.20824258980244 %**.

The forest area lost over this time period is slightly more than the entire land area of **Peru** listed for the year 2016 (which is **1279999.9891**).

2. REGIONAL OUTLOOK

In 2016, the percent of the total land area of the world designated as forest was **31.38** . The region with the highest relative forestation was **Latin America & Caribbean**, with **46.16%**, and the region with the lowest relative forestation was **Middle East & North Africa**, with **2.07%** forestation.

In 1990, the percent of the total land area of the world designated as forest was **32.42**. The region with the highest relative forestation was **Latin America & Caribbean**, with **51.03%**, and the region with the lowest relative forestation was **Middle East & North Africa** with **1.78%** forestation.

Table 2.1: Percent Forest Area by Region, 1990 & 2016:

Region	1990 Forest Percentage	2016 Forest Percentage
Latin America & Caribbean	51.03	46.16

Europe & Central Asia	37.28	38.04
North America	35.65	36.04
Sub-Saharan Africa	30.67	28.79
East Asia & Pacific	25.78	26.36
South Asia	16.51	17.51
Middle East & North Africa	1.78	2.07

The only regions of the world that decreased in percent forest area from 1990 to 2016 were **Latin America & Caribbean** (dropped from **51.03 %** to **46.16%**) and **Sub-Saharan Africa** (dropped from **30.67 %** to **28.79%**). All other regions actually increased in forest area over this time period. However, the drop in forest area in the two aforementioned regions was so large, the percent forest area of the world decreased over this time period from **32.42 %** to **31.38%**.

3. COUNTRY-LEVEL DETAIL

A. SUCCESS STORIES

There is one particularly bright spot in the data at the country level, **China**. This country actually increased in forest area from 1990 to 2016 by **527229.06 sq km**. It would be interesting to study what has changed in this country over this time to drive this figure in the data higher. The country with the next largest increase in forest area from 1990 to 2016 was the **United States**, but it only saw an increase of **79200.00 sq km**, much lower than the figure for **China**.

China and **United States** are of course very large countries in total land area, so when we look at the largest *percent* change in forest area from 1990 to 2016, we aren't surprised to find a much smaller country listed at the top. **Iceland** increased in forest area by **213.66%** from 1990 to 2016.

B. LARGEST CONCERNS

Which countries are seeing deforestation to the largest degree? We can answer this question in two ways. First, we can look at the absolute square kilometer decrease in forest area from 1990 to 2016. The following 3 countries had the largest decrease in forest area over the time period under consideration:

Table 3.1: Top 5 Amount Decrease in Forest Area by Country, 1990 & 2016:

Country	Region	Absolute Forest Area Change in sq km
Brazil	Latin America & Caribbean	54510.00
Indonesia	East Asia & Pacific	282193.98
Myanmar	East Asia & Pacific	107234.00
Nigeria	Sub-Saharan Africa	106506.00
Tanzania	Sub-Saharan Africa	10230.00

The second way to consider which countries are of concern is to analyze the data by percent decrease.

Table 3.2: Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016:

Country	Region	Pct Forest Area Change
Tongo	Sub-Saharan Africa	75.45
Nigeria	Sub-Saharan Africa	61.8
Uganda	Sub-Saharan Africa	59.13
Mauritania	Sub-Saharan Africa	46.75
Honduras	Latin America & Caribbean	45.03

When we consider countries that decreased in forest area the most between 1990 and 2016, we find that four of the top 5 countries on the list are in the region of **Sub-Saharan**. The countries are **Tongo**, **Nigeria**, **Uganda** and **Mauritania**. The 5th country on the list is **Honduras** which is in the **Latin America & Caribbean** region.

From the above analysis, we see that **Nigeria** is the only country that ranks in the top 5 both in terms of absolute square kilometer decrease in forest as well as percent decrease in forest area from 1990 to 2016. Therefore, this country has a significant opportunity ahead to stop the decline and hopefully spearhead remedial efforts.

C. QUARTILES

Table 3.3: Count of Countries Grouped by Forestation Percent Quartiles, 2016:

Quartile	Number of Countries
Fourth - (75-100)%	9

Third - (50-75)%	38
Second - (25-50)%	72
First - (0-25)%	85

The largest number of countries in 2016 were found in the **first (0-25)%** quartile.

There were **9** countries in the top quartile in 2016. These are countries with a very high percentage of their land area designated as forest. The following is a list of countries and their respective forest land, denoted as a percentage.

Table 3.4: Top Quartile Countries, 2016:

Country	Region	Pct Designated as Forest
Suriname	Latin America & Caribbean	98.2576939676578
Micronesia , Fed. Sts.	East Asia & Pacific	91.8572390715248
Gabon	Sub-Saharan Africa	90.0376418700565
Seychelles	Sub-Saharan Africa	88.4111367385789
Palau	East Asia & Pacific	87.6068085491203
American Samoa	East Asia & Pacific	87.5000875000875
Guyana	Latin America & Caribbean	83.9014489110682
Lao PDR	East Asia & Pacific	82.1082317640861
Solomon Islands	East Asia & Pacific	77.8635177945066

There are **94** countries that had a percent forestation higher than the United States in 2016.

5. RECOMMENDATIONS

Write out a set of recommendations as an analyst on the Forest Query team.

- *What have you learned from the World Bank data?*

*Deforestation, as we know means clearing of forested land for human usage has been one of the major concerns all around the globe. It has an extreme effect on the global warming. As seen from the analysis above ; it was derived that the total forest area in the world from 1990 to 2016 has significantly reduced from **41282694.9 sq km** to **39958245.9 sq km** which is approximately 3.28% reduction is alarming. As in the coverage of region statistics it was discovered that the regions that were adversely affected were Latin America & Caribbean and*

Sub-Saharan Africa but majorly has had a severe influence on the latter. From the country level analysis it was observed that China and USA has seen an increase in the forestation from 1990 to 2016. So, the main takeaways from the analysis that were conducted is that we all come together and make an attempt to decrease deforestation to our maximum possible. This definitely will take some time but doesn't seem to be impossible in the long run. So as allured from table 3.3 above, it's tracked that 9 countries fall into the top quartile level (75-100)% that has an increased percent of forest land ; where as there are 85 countries that fall in the fourth quartile (0-25)% which seems to be disappointing in my concern. The main aim driven is to basically have the major proportion or majority of the countries to fall into the top quartile and have increased number of countries all over the world.

- *Which countries should we focus on over others?*

Its vivid from the above analysis that Sub-Saharan Africa has seen a major drop in the forest area land. As allured from the table 3.2 ; the top 5 countries are Tongo, Nigeria, Uganda, Mauritania and Honduras; Tongo, Nigeria, Uganda experience a decrease in 75.45%, 61.8%, 59.13% respectively which are major concerns. Also, we can explore more along the lines of the countries – China and USA that have encountered a rise in the forestation area and also introduce suitable measures and strategies which can also be followed by the other more affected countries in order to mitigate and combat the same provided they have the political will and the national vision. From this research study ; the main factors contributing to deforestation in the Sub Saharan Africa include – population density , rural population , rural poverty, industrial logging for commercial purposes , infrastructural expansion such as urbanization/mining , subsistence agricultural development leading to slow economic growth , poor governance and effective forestation laws. The initiatives that can be taken to plan out for reforestation and afforestation includes – implementation of Forest Protection Schemes and Acts by the government – creation of forest reserves and national parks , regulation of industrial logging, minimization of human activities and controlled population growth for the environment and effective law enforcement machinery should be in place.

CONCLUSIONS-

As derived from the study , deforestation is a tropical issue. The causes of deforestation are complex and multifaceted having a wide range of socio economic dimensions causing disruptions in the ecological imbalance besides with the interference of wildlife and human beings. To address this issue, Sub-Saharan African nations, donor nations, and NGO's must collaborate. Although external factors can contribute to a declination in population, it will be more useful in a supportive capacity. NGO's and Western nations can educate African nations about the issue of deforestation and offer solutions, but African countries themselves must bear the major duty because ultimately, it is their citizens who are most impacted.

APPENDIX - SQL Queries Used

BUILDING A VIEW -

```

CREATE VIEW forestation AS
SELECT
    foa.country_code,
    foa.country_name,
    foa.year,
    foa.forest_area_sqkm,
    la.total_area_sq_mi,
    la.total_area_sq_mi * 2.59 AS total_area_sqkm,
    r.region,
    r.income_group,
    (foa.forest_area_sqkm * 100) / (total_area_sq_mi * 2.59) AS percentage
FROM
    forest_area AS foa
    JOIN land_area AS la ON foa.country_code = la.country_code
    AND foa.year = la.year
    JOIN regions AS r ON r.country_code = foa.country_code;

```

1. GLOBAL SITUATION

Q. a) What was the total forest area (in sq km) of the world in 1990? Please keep in mind that you can use the country record denoted as "World" in the region table.

```

SELECT
    SUM(forest_area_sqkm)
FROM
    forestation
WHERE
    year = '1990'
    AND region = 'World';

```

Q. b) What was the total forest area (in sq km) of the world in 2016? Please keep in mind that you can use the country record in the table is denoted as "World."

```

SELECT
    SUM(forest_area_sqkm)
FROM
    forestation
WHERE
    year = '2016'
    AND region = 'World';

```

Q.c) What was the change (in sq km) in the forest area of the world from 1990 to 2016?

```

SELECT
(
    fa_ch1.forest_area_sqkm - fa_ch2.forest_area_sqkm
) AS forest_area_change
FROM
    forestation AS fa_ch1,
    Forestation AS fa_ch2
WHERE
    fa_ch1.year = 1990
    AND fa_ch1.region = 'World'
    AND fa_ch2.year = 2016
    AND fa_ch2.region = 'World';

```

Q.d) What was the percent change in forest area of the world between 1990 and 2016?

```

SELECT
(
    (
        fa_ch1.forest_area_sqkm - fa_ch2.forest_area_sqkm
    ) / fa_ch1.forest_area_sqkm * 100
) AS percent_change
FROM
    forestation AS fa_ch1,
    forestation AS fa_ch2
WHERE
    fa_ch1.year = 1990
    AND fa_ch1.region = 'World'
    AND fa_ch2.year = 2016
    AND fa_ch2.region = 'World';

```

Q.e) If you compare the amount of forest area lost between 1990 and 2016, to which country's total area in 2016 is its closest to?

```

SELECT
    country_name,
    (total_area_sq_mi * 2.59) AS country_area
FROM
    land_area
WHERE
    year = 2016
    AND total_area_sq_mi * 2.59 <= 1324449
GROUP BY
    1,

```

```
2
ORDER BY
  2 DESC
LIMIT
  1
```

2. REGIONAL OUTLOOK

Q.a) What was the percent forest of the entire world in 2016? Which region had the HIGHEST percent forest in 2016, and which had the LOWEST, to 2 decimal places?

Q.b) What was the percent forest of the entire world in 1990? Which region had the HIGHEST percent forest in 1990, and which had the LOWEST, to 2 decimal places?

Q.c) Based on the table you created, which regions of the world DECREASED in forest area from 1990 to 2016?

So splitting the question 2a and 2b into two parts. Firstly being, the percent of forest area for 2016 and 1990 can be found separately. Then addressing the latter part to find out region with the highest and lowest percentage of forest area for both 2016 and 1990.

Percentage of forest area for 2016 and 1990 can be found using the below queries -

```
SELECT
  ROUND(percentage :: numeric, 2)
FROM
  forestation
WHERE
  year = 2016
  AND country_name = 'World'
```

```
SELECT
  ROUND(percentage :: numeric, 2)
FROM
  forestation
WHERE
  year = 1990
  AND country_name = 'World'
```

Region with the highest and lowest percentage of forest area for both 2016 and 1990 can be addressed by -

```
SELECT
```



```

ROUND(
  CAST(
    (
      region_forest_1990 / region_area_1990
    ) * 100 AS NUMERIC
  ),
  2
) AS percentage_of_forest_area_1990,
ROUND(
  CAST(
    (
      region_forest_2016 / region_area_2016
    ) * 100 AS NUMERIC
  ),
  2
) AS percentage_of_forest_area_2016,
region
FROM
(
  SELECT
    SUM(tb1.forest_area_sqkm) AS region_forest_1990,
    SUM(tb1.total_area_sqkm) AS region_area_1990,
    tb1.region,
    SUM(tb2.forest_area_sqkm) AS region_forest_2016,
    SUM(tb2.total_area_sqkm) AS region_area_2016
  FROM
    forestation AS tb1,
    forestation AS tb2
  WHERE
    tb1.year = '1990'
    AND tb1.country_name != 'World'
    AND tb2.year = '2016'
    AND tb2.country_name != 'World'
    AND tb1.region = tb2.region
  GROUP BY
    tb1.region
) AS percentage_region
ORDER BY
  percentage_of_forest_area_1990 DESC;

```

For the 2c) we can compare and understand the answers from the table executed from the same queries above which are included in the Table 2.1 : Percent Forest Area by Region, 1990 & 2016.

3. COUNTRY-LEVEL DETAIL

A. SUCESS STORIES

Countries with an increased difference in the forest area is found using the below query

```
WITH table1 AS (  
  SELECT  
    country_name,  
    forest_area_sqkm,  
    total_area_sqkm  
  FROM  
    forestation  
  WHERE  
    year = 1990  
)  
table2 AS (  
  SELECT  
    country_name,  
    forest_area_sqkm,  
    total_area_sqkm  
  FROM  
    forestation  
  WHERE  
    year = 2016  
)  
SELECT  
  table1.country_name,  
  table1.forest_area_sqkm AS forest_area_for_1990,  
  table2.forest_area_sqkm AS forest_area_for_2016,  
  ROUND(  
    CAST(  
      (  
        table2.forest_area_sqkm - table1.forest_area_sqkm  
      ) AS numeric  
    ),  
    2  
  ) AS difference,  
  ROUND(  
    CAST(  
      (  
        (  
          table2.forest_area_sqkm - table1.forest_area_sqkm  
        ) * 100 / table1.total_area_sqkm  
      )
```

```

        ) AS numeric
    ),
    2
    ) AS increase_percent
FROM
    table1
    JOIN table2 ON table1.country_name = table2.country_name
WHERE
    table2.forest_area_sqkm > table1.forest_area_sqkm
ORDER BY
    difference DESC

```

Countries with increased forest area is found using the below query – Ireland with an increase of 213.66%

```

WITH table1 AS(
    SELECT
        country_name,
        forest_area_sqkm
    FROM
        forestation
    WHERE
        year = 1990
),
table2 AS(
    SELECT
        country_name,
        forest_area_sqkm
    FROM
        forestation
    WHERE
        year = 2016
)
SELECT
    table1.country_name,
    table1.forest_area_sqkm AS forest_area_1990,
    table2.forest_area_sqkm AS forest_2016,
    ROUND(
        CAST(
            (
                table2.forest_area_sqkm - table1.forest_area_sqkm
            ) AS numeric
        ),
    ),

```

```

2
) AS difference,
ROUND(
  CAST(
    (
      (
        table2.forest_area_sqkm - table1.forest_area_sqkm
      ) * 100 / table1.forest_area_sqkm
    ) AS numeric
  ),
  2
) AS percentage_increase
FROM
  table1
  JOIN table2 ON table1.country_name = table2.country_name
WHERE
  table2.forest_area_sqkm > table1.forest_area_sqkm
ORDER BY
  percentage_increase DESC

```

B. LARGEST CONCERNS

Q.a) Which 5 countries saw the largest amount decrease in forest area from 1990 to 2016? What was the difference in forest area for each?

```

WITH table1 AS (
  SELECT
    region,
    country_name,
    forest_area_sqkm
  FROM
    forestation
  WHERE
    year = 1990
),
table2 AS (
  SELECT
    region,
    country_name,
    forest_area_sqkm
  FROM
    forestation
  WHERE

```

```

    year = 2016
)
SELECT
    table1.region,
    table1.country_name,
    table1.forest_area_sqkm AS forest_1990,
    table2.forest_area_sqkm AS forest_2016,
    ROUND(
        CAST(
            (
                table1.forest_area_sqkm - table2.forest_area_sqkm
            ) AS numeric
        ),
        2
    ) AS difference_foa_from_1990_2016
FROM
    table1
    JOIN table2 ON table1.country_name = table2.country_name
WHERE
    table2.forest_area_sqkm < table1.forest_area_sqkm
    AND table1.region NOT LIKE 'World'
ORDER BY
    difference_foa_from_1990_2016 DESC
LIMIT
    5

```

Q.b.) Which 5 countries saw the largest percent decrease in forest area from 1990 to 2016? What was the percent change to 2 decimal places for each?

```

WITH table1 AS (
    SELECT
        region,
        country_name,
        forest_area_sqkm
    FROM
        forestation
    WHERE
        year = 1990
),
table2 AS (
    SELECT
        region,
        country_name,
        forest_area_sqkm
    FROM

```

```

        forestation
WHERE
    year = 2016
)
SELECT
    table1.region,
    table1.country_name,
    table1.forest_area_sqkm AS forest_1990,
    table2.forest_area_sqkm AS forest_2016,
    ROUND(
        CAST(
            (
                table1.forest_area_sqkm - table2.forest_area_sqkm
            ) AS numeric
        ),
        2
    ) AS difference,
    ROUND(
        CAST(
            (
                (
                    table1.forest_area_sqkm - table2.forest_area_sqkm
                ) * 100 / table1.forest_area_sqkm
            ) AS numeric
        ),
        2
    ) AS percentage_decrease
FROM
    table1
    JOIN table2 ON table1.country_name = table2.country_name
WHERE
    table2.forest_area_sqkm < table1.forest_area_sqkm
ORDER BY
    percentage_decrease DESC
LIMIT
    5;

```

C. QUARTILES

Q.c) If countries were grouped by percent forestation in quartiles, which group had the most countries in it in 2016?

```

WITH table1 AS (
    SELECT
        *

```

```

FROM
    forestation
WHERE
    year = 2016
    AND region NOT LIKE 'World'
    AND percentage IS NOT NULL
),
table2 AS (
    SELECT
        *,
        CASE WHEN percentage > 75 THEN '75% - 100%' WHEN percentage <= 75
        AND percentage > 50 THEN '50% - 75%' WHEN percentage <= 50
        AND percentage > 25 THEN '25% - 50%' ELSE '0% - 25%' END AS quartiles
    FROM
        table1
)
SELECT
    quartiles,
    COUNT(*) AS quartiles_groups
FROM
    table2
GROUP BY
    1;

```

Q.d) List all of the countries that were in the 4th quartile (percent forest > 75%) in 2016.

```

SELECT
    country_name,
    region,
    percentage
FROM
    forestation
WHERE
    percentage > 75
    AND percentage IS NOT NULL
    AND year = 2016
ORDER BY
    3 DESC;

```

Q.e) How many countries had a percent forestation higher than the United States in 2016?

```

SELECT
    COUNT(country_name)

```

```
FROM
  forestation
WHERE
  year = 2016
AND percentage > (
  SELECT
    percentage
  FROM
    forestation
  WHERE
    country_name = 'United States'
    AND year = 2016
);
```