

# Report for ForestQuery into Global Deforestation, 1990 to 2016

ForestQuery 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 ForestQuery 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 **41,282,694.9 km<sup>2</sup>** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39,958,245.9 km<sup>2</sup>**, a loss of **1,324,449 km<sup>2</sup>**, or **3.2%**.

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 **1,279,999.98 km<sup>2</sup>**).

## 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 **46.14%**, 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:

<i><b>Region</b></i>	<i><b>1990 Forest Percentage</b></i>	<i><b>2016 Forest Percentage</b></i>
Middle East & North Africa	1.78	2.07
South Asia	16.53	17.50
East Asia & Pacific	25.78	26.36
Sub-Saharan Africa	30.67	28.79
World	32.42	31.38
North America	35.66	36.02
Europe & Central Asia	37.20	38.07
Latin America & Caribbean	37.20	46.14

The only regions of the world that decreased in percent forest area from 1990 to 2016 were **Sub-Saharan Africa** (dropped from **30.67%** to **28.79%**) and Latin America & Caribbean (**37.20%** to **46.14%**). 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 **527,229.062 km<sup>2</sup>**. 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 **79,200 km<sup>2</sup>**, much lower than the figure for **China**.

**China** and **The 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
Brazil	Latin America & Caribbean	541,510.00 km <sup>2</sup>
Indonesia	East Asia & Pacific	282,193.98 km <sup>2</sup>
Myanmar	East Asia & Pacific	107,234.00 km <sup>2</sup>
Nigeria	Sub-Saharan Africa	106,506.00 km <sup>2</sup>
Tanzania	Sub-Saharan Africa	102,320.00 km <sup>2</sup>

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
Togo	Sub-Saharan Africa	75.45 %
Nigeria	Sub-Saharan Africa	61.80 %
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 Africa**. The countries are **Togo**, **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
0-25	85
25-50	72
50-75	38
75-100	9

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	98.26
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Gabon	Sub-Saharan Africa	90.04
Seychelles	Sub-Saharan Africa	88.41
Palau	East Asia & Pacific	87.60
American Samoa	East Asia & Pacific	87.5
Guyana	Latin America & Caribbean	83.9
Lao PDR	East Asia & Pacific	82.11
Solomon Islands	East Asia & Pacific	77.86
Papua New Guinea	East Asia & Pacific	74.09

## 5. RECOMMENDATIONS

*Write out a set of recommendations as an analyst on the ForestQuery team.*

- *What have you learned from the World Bank data?*
- *Which countries should we focus on over others?*

After analyzing forestation data, I got some interesting results. First, I got the general data of forestation in the world. I focused mainly 2 different years (1990 and 2016). I realized that most of the countries have increased amount of forest. However, overall, amount of forest decreased in the world between 1990 and 2016.

One of interesting result I got from China. The data shows that China increased in forest area from 1990 to 2016 by **527,229.062 km<sup>2</sup>**. I would recommend that we can try to learn the method that China used during the years. Especially, Brazil should do something about deforestation that they had.

### Explanation of the codes Global Situation

#### 1- How did I find total forest area of the world in 1990 and in 2016

```
SELECT SUM(forest_area_sqkm) total_forest_area
FROM forest_area
WHERE YEAR = 1990
AND country_name = 'World'
```

```
SELECT SUM(forest_area_sqkm) total_forest_area
FROM forest_area
WHERE YEAR = 2016
AND country_name = 'World'
```

#### 2- I used pseudo select statement to find difference in km<sup>2</sup> between two years

```
SELECT((SELECT SUM(forest_area_sqkm) total_forest_area
FROM forest_area
WHERE YEAR = 1990
AND country_name = 'World') -
(SELECT SUM(forest_area_sqkm) total_forest_area
FROM forest_area
```

```
WHERE YEAR = 2016
AND country_name = 'World' )) AS difference
```

- 3- Due to find percentage I used same technique, but a little complicated way. In short I divided difference that we found to total forest area in 1990.

```
SELECT(SELECT((SELECT SUM(forest_area_sqkm) total_forest_area
FROM forest_area
WHERE YEAR = 1990
AND country_name = 'World') -
(SELECT SUM(forest_area_sqkm) total_forest_area
FROM forest_area
WHERE YEAR = 2016
AND country_name = 'World' )) AS difference)/(SELECT SUM(forest_area_sqkm)
total_forest_area
FROM forest_area
WHERE YEAR = 1990
AND country_name = 'World') AS percentage
```

- 4- Here from land\_area table we get land area, but we should take into account that area is given in miles, not in kilometers. This is why I converted mile to kilometer with multiply area to 2.59.

```
SELECT *
FROM land_area
WHERE year='2016' AND (total_area_sq_mi*2.59)<=1324449
ORDER BY total_area_sq_mi DESC
LIMIT 1
```

## REGIONAL OUTLOOK

- 1- For to find total forest area in the world in 2016, I divided total forest area to total land area of the world.

```
SELECT((SELECT forest_area_sqkm
FROM forest_area
WHERE country_name='World' AND year='2016') /
(SELECT total_area_sq_mi*2.59
FROM land_area
WHERE country_name='World' AND year='2016'))
```

- 2- I used the code below to find the region which has more land to cover the land. Here we see 8 regions. In order to find lowest and highest, I put the list to order.

```

SELECT regions.region,
       Round((((Sum(forest_area_sqkm) / Sum(total_area_sq_mi*2.59))*100)::Numeric, 2) AS
percent_forest
FROM forest_area
JOIN land_area
ON forest_area.country_code=land_area.country_code
JOIN regions
ON land_area.country_code=regions.country_code
WHERE forest_area.year = '2016'
GROUP BY regions.region
ORDER BY percent_forest

```

- 3- In order to find forest statistic in 1990 I used same line of codes. I just change year to 1990.

## COUNTRY LEVEL DETAILS

For section A I used the code below. In order to use both table efficiently I used with subquery. For that I got the results for 1990 and 2016 and after that I picked the column that I need in select section, or I added some columns that demonstrate differences and percentage between 2016 and 1990.

```

WITH table1 AS (SELECT f.country_name,
                      f.forest_area_sqkm,
                      f.year,
                      f.country_code
FROM forest_area f
WHERE year='1990' AND f.forest_area_sqkm is not Null
AND f.country_name != 'World'),

      table2 AS (SELECT f.country_name,
                      f.forest_area_sqkm,
                      f.year,
                      f.country_code
FROM forest_area f
WHERE year='2016' AND f.forest_area_sqkm is not Null
AND f.country_name != 'World')
SELECT table1.country_name,

```

```

        table1.country_code,
        r.region,
        table1.forest_area_sqkm as forest_areasqkm_1990,
        table2.forest_area_sqkm as forest_areasqkm_2016,
        table1.forest_area_sqkm-table2.forest_area_sqkm as diff_area_sqkm,

        ABS(ROUND(CAST((((table2.forest_area_sqkm-
table1.forest_area_sqkm)/table1.forest_area_sqkm*100) AS NUMERIC),2)) AS
perc_change
        FROM table1
        JOIN table2
        ON table1.country_code = table2.country_code
        AND (table1.forest_area_sqkm IS NOT NULL AND table2.forest_area_sqkm IS NOT
NULL) JOIN regions r ON table2.country_code = r.country_code
        Order by diff_area_sqkm

```

In the section B we do not need to do so much. We just need to play on the code above. Only thing that I did to add

```

ORDER BY diff_area_sqkm desc
LIMIT 5

```

And found 5 countries that had lost forest area. And for comparing percentage I used this:

```

WHERE table1.forest_area_sqkm-table2.forest_area_sqkm>0
ORDER by perc_change desc
LIMIT 5

```

I used case when method to find quartiles.

```

With table1 AS (SELECT f.country_code,
        f.country_name,
        f.year,
        f.forest_area_sqkm,
        l.total_area_sq_mi*2.59 AS total_area_sqkm,
        (f.forest_area_sqkm/(l.total_area_sq_mi*2.59))*100 AS perc_fa
        FROM forest_area f
        JOIN land_area l
        ON f.country_code = l.country_code

```



```

        AND (f.country_name != 'World' AND f.forest_area_sqkm IS NOT NULL
AND l.total_area_sq_mi IS NOT NULL)
        AND (f.year=2016 AND l.year = 2016)
        ORDER BY 6 DESC

```

```

    ),
    table2 AS (SELECT table1.country_code,
        table1.country_name,
        table1.year,
        table1.perc_fa,
        CASE WHEN table1.perc_fa >= 75 THEN '75-100'
            WHEN table1.perc_fa < 75 AND table1.perc_fa >= 50 THEN '50-75'
            WHEN table1.perc_fa < 50 AND table1.perc_fa >=25 THEN '25-50'
            ELSE '0-25'
        END AS percentile
        FROM table1 ORDER BY 5 DESC
    )

```

```

SELECT table2.percentile,
    COUNT(table2.percentile)
FROM table2
GROUP BY 1
ORDER BY 2 DESC;

```

For Last table I used the code below:

```

With table1 AS (SELECT f.country_code,
    f.country_name,
    f.year,
    f.forest_area_sqkm,
    r.region,
    l.total_area_sq_mi*2.59 AS total_area_sqkm,
    (f.forest_area_sqkm/(l.total_area_sq_mi*2.59))*100 AS perc_fa
FROM forest_area f
JOIN land_area l
ON f.country_code = l.country_code
JOIN regions r
ON l.country_code=r.country_code
AND (f.country_name != 'World' AND f.forest_area_sqkm IS NOT NULL AND
l.total_area_sq_mi IS NOT NULL)
AND (f.year=2016 AND l.year = 2016)
ORDER BY 6 DESC
),
table2 AS (SELECT table1.country_code,
    table1.country_name,

```

```
        table1.year,  
        table1.perc_fa  
        FROM table1  
    )
```

```
SELECT table1.country_name, table1.region,perc_fa  
FROM table1  
Order by perc_fa desc  
LIMIT 10
```