

# 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 **3.21%**.

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 **1,279,999.99 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 **46.16%**, 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%
World	32.42%	31.38%
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** (**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 **527,229.06 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 of America**, but it only saw an increase of **79,200.00 km<sup>2</sup>**, much lower than the figure for **China**.

**China** and the **United States of America** 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** in forest area increased 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	59.27%
Mauritania	Sub-Saharan Africa	46.75%
Honduras	Latin America & Caribbean	45.03%

When we consider countries that decreased in forest area percentage 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%	73
50-75%	38
75-100%	9

The largest number of countries in 2016 were found in the **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	87.61%
American Samoa	Sub-Saharan Africa	87.50%
Guyana	Latin America & Caribbean	83.90%
Lao PDR	East Asia & Pacific	82.11%
Solomon Islands	East Asia & Pacific	77.86%

## 4. RECOMMENDATIONS

Based on the World Bank data, I learned that the world is changing. Globally, there are many regions that are increasing in forest areas. However, we couldn't ignore the fact that some regions also experienced decreases between 1990 and 2016. We shouldn't focus only on maintaining growth without dealing with decreases. Therefore, I suggest best to focus on the regions with high levels of decrease while also paying attention to the forests that are being changed. It is a wise idea to learn from China's success in increasing forest areas to help those who have lost them.

## 5. APPENDIX: SQL queries used for analysis

```
/* create a View called "forestation"  
by joining all three data tables */  
  
-- add this line to drop VIEW if it already exists  
  
DROP VIEW IF EXISTS forestation;  
  
CREATE VIEW forestation AS  
SELECT fa.country_name,  
        fa.country_code,  
        fa.year,  
        fa.forest_area_sqkm,  
        r.income_group,  
        r.region,  
        la.total_area_sq_mi,  
        (fa.forest_area_sqkm / (la.total_area_sq_mi * 2.59)) * 100 AS  
percentage_forest  
FROM forest_area fa  
JOIN land_area la  
ON fa.country_code = la.country_code AND fa.year = la.year  
JOIN regions r  
ON r.country_code = fa.country_code  
  
SELECT * FROM forestation;
```

--GLOBAL SITUATION

*/\* 1A total forest area of the world in 1990 \*/*

```
SELECT forest_area_sqkm AS total_forest_area
FROM forestation
WHERE year = 1990
AND country_name = 'World';
```

*/\* 1B total forest area of the world in recent year as of 2016 \*/*

```
SELECT forest_area_sqkm AS total_forest_area
FROM forestation
WHERE year = 2016
AND country_name = 'World';
```

*/\* 1C the loss of the total forest area of the world  
in recent years as of 2016 \*/*

```
SELECT ((SELECT forest_area_sqkm AS total_forest_area
        FROM forestation
        WHERE year = 1990
        AND country_name = 'World') -
        (SELECT forest_area_sqkm AS total_forest_area
        FROM forestation
        WHERE year = 2016
        AND country_name = 'World')) AS Difference
FROM forestation
LIMIT 1;
```

*/\* 1D the loss of the total forest area of the world  
in recent years as of 2016 in percentage \*/*

```
SELECT ((
    ((SELECT forest_area_sqkm total_forest_area
    FROM forestation
    WHERE year = 1990
    AND country_name = 'World') -
    (SELECT forest_area_sqkm total_forest_area
    FROM forestation
    WHERE year = 2016
```

```

        AND country_name = 'World'))
    /
    (SELECT forest_area_sqkm total_forest_area
     FROM forestation
     WHERE year = 1990
     AND country_name = 'World')) * 100.0) AS Percent_decrease
FROM forestation
LIMIT 1;

```

*/\* 1E and 1F the loss of the total forest area  
over this period slightly more than this land area \*/*

```

SELECT country_name, (total_area_sq_mi*2.59) total_land_area
FROM forestation
WHERE year = 2016
AND total_area_sq_mi IS NOT NULL
GROUP BY country_name,
         total_area_sq_mi
ORDER BY total_land_area DESC;

```

*-- REGIONAL OUTLOOK*

*/\* 2A the percent of the total Land area as a forest in the world 2016 \*/*

```

SELECT country_name,
Round(((Sum(forest_area_sqkm) / Sum(total_area_sq_mi*2.59))*100)::Numeric,
2) AS percent_forest
FROM forestation
WHERE year = 2016
AND country_name = 'World'
GROUP BY country_name;

```

*/\* 2B The region with the highest and lowest relative forestation 2016 \*/*

```

SELECT region,
Round(((Sum(forest_area_sqkm) / Sum(total_area_sq_mi*2.59))*100)::Numeric,
2) AS percent_forest_region
FROM forestation
WHERE year = 2016
GROUP BY region
ORDER BY percent_forest_region DESC;

```

*/\* 2C the percent of the total Land area as a forest in the world 1990 \*/*

```

SELECT country_name,
Round(((Sum(forest_area_sqkm) /
Sum(total_area_sq_mi*2.59))*100)::Numeric,2) AS percent_forest
FROM forestation
WHERE year = 1990
AND country_name = 'World'
GROUP BY country_name;

```

*/\* 2D The region with the highest and lowest relative forestation 1990 \*/*

```

SELECT region,
Round(((Sum(forest_area_sqkm) /
Sum(total_area_sq_mi*2.59))*100)::Numeric,2) AS percent_forest_region
FROM forestation
WHERE year = 1990
GROUP BY region
ORDER BY percent_forest_region DESC;

```

*-- more specific but without the percentage*

```

SELECT region,
ROUND(CAST(percent_forest as numeric), 2)
FROM forestation
WHERE year = 2016 and region <> 'World'
ORDER by percent_forest DESC
LIMIT 1;

```

*/\* table 2.1 comparison 1990 and 2016 \*/*



```

WITH forest_1990 AS
    (SELECT region,
        Round(((Sum(forest_area_sqkm) / Sum(total_area_sq_mi*2.59)) *
100)::Numeric,2) AS percent_forest_1990
        FROM forestation
        WHERE year = 1990
        GROUP BY region
        ORDER BY percent_forest_1990 DESC),

forest_2016 AS
    (SELECT region,
        Round(((Sum(forest_area_sqkm) / Sum(total_area_sq_mi*2.59)) *
100)::Numeric, 2) AS percent_forest_2016
        FROM forestation
        WHERE year = 2016
        GROUP BY region
        ORDER BY percent_forest_2016 DESC)

SELECT *
FROM forest_1990
JOIN forest_2016
ON forest_1990.region = forest_2016.region

```

```

-- COUNTRY-LEVEL DETAIL
-- 3A SUCCESS STORIES

```

```

SELECT recent.country_name,
        recent.forest_area_sqkm - past.forest_area_sqkm AS difference
FROM forest_area AS recent
JOIN forest_area AS past
ON (recent.year = '2016' AND past.year = '1990')
AND recent.country_name = past.country_name
WHERE recent.forest_area_sqkm - past.forest_area_sqkm IS NOT NULL
ORDER BY difference DESC
LIMIT 2;

```

```

-- 3B LARGEST CONCERNS

```

```

WITH past AS
    (SELECT country_name,
        ((SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59)) * 100) AS
percent_forestation_1
    FROM forestation
    WHERE year = 1990
    GROUP BY country_name),

recent AS
    (SELECT country_name,
        ((SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59)) * 100) AS
percent_forestation_2
    FROM forestation
    WHERE year = 2016 GROUP BY country_name)

SELECT p.country_name,
    ROUND((((p.percent_forestation_1 - r.percent_forestation_2) /
p.percent_forestation_1) * 100)::Numeric, 2) AS percent_forest_change
FROM past p
JOIN recent r
ON p.country_name = r.country_name
ORDER BY percent_forest_change
LIMIT 2;

```

-- Table 3.1

```

WITH past AS
    (SELECT country_name, SUM(forest_area_sqkm) AS past_forest_area
    FROM forestation
    WHERE YEAR = 1990
    GROUP BY country_name),

recent AS
    (SELECT country_name, SUM(forest_area_sqkm) AS recent_forest_area
    FROM forestation
    WHERE YEAR = 2016
    GROUP BY country_name)

SELECT p.country_name, (p.past_forest_area - r.recent_forest_area) AS
forest_change
FROM past p

```

```

JOIN recent r
ON p.country_name = r.country_name
WHERE p.past_forest_area IS NOT NULL
AND r.recent_forest_area IS NOT NULL
AND p.country_name != 'World'
ORDER BY forest_change DESC
LIMIT 5;

```

*-- table 3.2*

```

WITH past AS
    (SELECT country_name,
        ((SUM(forest_area_sqkm)) / (SUM(total_area_sq_mi*2.59))) * 100 AS
past_percent_forestation
    FROM forestation
    WHERE year = 1990
    GROUP BY country_name),

```

```

recent AS
    (SELECT country_name,
        ((SUM(forest_area_sqkm)) / (SUM(total_area_sq_mi*2.59))) * 100 AS
recent_percent_forestation
    FROM forestation
    WHERE year = 2016
    GROUP BY country_name)

```

```

SELECT p.country_name,
    Round((((p.past_percent_forestation - r.recent_percent_forestation) /
(p.past_percent_forestation)) *100)::Numeric, 2) AS percent_change
FROM past p
JOIN recent r
ON p.country_name = r.country_name
WHERE p.past_percent_forestation IS NOT NULL
AND r.recent_percent_forestation IS NOT NULL
AND p.country_name != 'World'
ORDER BY percent_change DESC
LIMIT 5;

```

*-- 3C QUARTILES*

-- table 3.3

```
WITH recent AS
  (SELECT country_name, year,
    (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100
  percent_forestation
  FROM forestation
  WHERE year = 2016
  GROUP BY country_name, year, forest_area_sqkm)

SELECT DISTINCT(quartiles), count(country_name)Over(PARTITION BY quartiles)
FROM
  (SELECT country_name, CASE
    WHEN percent_forestation<25 THEN '0-25' WHEN percent_forestation>=25
    AND percent_forestation<50 THEN '25-50' WHEN percent_forestation>=50
    AND percent_forestation<75 THEN '50-75' ELSE '75-100'
  END AS quartiles FROM recent
  WHERE percent_forestation IS NOT NULL AND YEAR = 2016) sub
```

-- table 3.4

```
SELECT country_name, percentage_forest
FROM forestation
WHERE percentage_forest > 75 AND year = 2016
ORDER BY percentage_forest DESC;
```