

# 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 494,208.49 mi<sup>2</sup> (1,280,000 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 46.2%, 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 32.4%. 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 (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 527,229.062 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 2.14% 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 square kilometers
Indonesia	East Asia & Pacific	282,193.98 square kilometers
Myanmar	East Asia & Pacific	107,234 square kilometers

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	0.75%
Nigeria	Sub-Saharan Africa	0.62%
Uganda	Sub-Saharan Africa	0.59%

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
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1	85
2	73
3	38
4	9

The largest number of countries in 2016 were found in the first 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	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%

## 4. RECOMMENDATIONS

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

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

From this World Bank data, I have learned that the amount of area designated as forest for the whole world has decreased, though the amount forested in many regions has increased. This shows that there are some regions that have a lot less forest now, and this impacts the relative amount forested in the whole world. The data shows that the amount forested in lot of countries has decreased.

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

Countries that should be focused on include countries in the Sub-Saharan Africa region, especially Nigeria and Togo, as these countries have lost the most forested area proportional to their total area. Brazil should also be a focus, as it has lost the most forest overall and is in a region (Latin America & Caribbean) that has lost a significant amount of forest.

## APPENDIX: SQL Queries Used

Create “forestation” view:

```
CREATE VIEW forestation
AS
SELECT fa.country_code, fa.country_name, fa.year, fa.forest_area_sqkm,
       la.total_area_sq_mi, r.region, r.income_group,
       ((fa.forest_area_sqkm / la.total_area_sq_mi) / 2.59) * 100
       AS percent_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 fa.country_code = r.country_code;
```

Forest Area of the world in 1990:

```
SELECT forest_area_sqkm
FROM forest_area
WHERE country_name = 'World' AND year = 1990;
```

Forest Area of the world in 2016:

```
SELECT forest_area_sqkm
FROM forest_area
WHERE country_name = 'World' AND year = 2016;
```

Change in forest area of world from 1990 to 2016:

```
SELECT (SELECT forest_area_sqkm
        FROM forest_area
        WHERE country_name = 'World' AND year = 1990) -
(SELECT forest_area_sqkm
        FROM forest_area
        WHERE country_name = 'World' AND year = 2016) AS forest_loss;
```

Percent change in forest area of the world from 1990 to 2016:

```
SELECT ((SELECT forest_area_sqkm
        FROM forest_area
        WHERE country_name = 'World' AND year = 1990) -
(SELECT forest_area_sqkm
        FROM forest_area
        WHERE country_name = 'World' AND year = 2016)) /
(SELECT forest_area_sqkm
        FROM forest_area
        WHERE country_name = 'World' AND year = 1990) * 100 AS
percent_loss
```

Country with total area closest to amount of forest area lost in the world:

```
SELECT country_code, country_name, total_area_sq_mi
FROM forestation
WHERE total_area_sq_mi * 2.59 <
      (SELECT (SELECT forest_area_sqkm
                FROM forest_area
                WHERE country_name = 'World' AND year = 1990) -
      (SELECT forest_area_sqkm
                FROM forest_area
                WHERE country_name = 'World' AND year = 2016))
      AND year = '2016'
ORDER BY total_area_sq_mi DESC
LIMIT 1;
```

Create table with regions and their percent forest area:

```
SELECT year, region,
       ((SUM(forest_area_sqkm) / SUM(total_area_sq_mi)) / 2.59) * 100
       AS region_percent_forest
FROM forestation
WHERE year IN ('1990', '2016')
GROUP BY region, year
ORDER BY region, year;
```

5 countries with the largest amount decrease in forest area:

```
SELECT t1.country_name, t1.region,
       t1.forest_area_1990 - t2.forest_area_2016 AS forest_decrease
FROM (SELECT country_name, region,
             forest_area_sqkm AS forest_area_1990
       FROM forestation
       WHERE year = '1990') t1
JOIN (SELECT country_name, region,
             forest_area_sqkm AS forest_area_2016
       FROM forestation
       WHERE year = '2016') t2
ON t1.country_name = t2.country_name
WHERE t2.forest_area_2016 < t1.forest_area_1990
AND t1.country_name != 'World'
ORDER BY forest_decrease DESC
LIMIT 5;
```

5 countries with the largest percent decrease in forest area:

```
SELECT t1.country_name, t1.region,
       (t1.forest_area_1990 - t2.forest_area_2016) /
       t1.forest_area_1990 AS percent_forest_decrease
FROM (SELECT country_name, region, forest_area_sqkm
      AS forest_area_1990
      FROM forestation
      WHERE year = '1990') t1
JOIN (SELECT country_name, region, forest_area_sqkm
      AS forest_area_2016
      FROM forestation
      WHERE year = '2016') t2
ON t1.country_name = t2.country_name
WHERE t2.forest_area_2016 < t1.forest_area_1990
ORDER BY percent_forest_decrease DESC
LIMIT 5;
```

Group countries into quartiles by percent forestation

```
SELECT country_name, percent_forest,
       CASE WHEN percent_forest < 25 THEN 1
            WHEN percent_forest <= 50 THEN 2
            WHEN percent_forest <= 75 THEN 3
            ELSE 4 END AS quartile
FROM forestation
WHERE year = '2016' AND percent_forest IS NOT NULL;
```



All countries in 4<sup>th</sup> Quartile:

```
WITH t1 AS (SELECT country_name, region, percent_forest,
                  CASE WHEN percent_forest < 25 THEN 1
                       WHEN percent_forest <= 50 THEN 2
                       WHEN percent_forest <= 75 THEN 3
                       ELSE 4 END AS quartile
                  FROM forestation
                  WHERE year = '2016' AND percent_forest IS NOT NULL)

SELECT country_name, region, percent_forest
FROM t1
WHERE quartile = 4
ORDER BY percent_forest DESC;
```

Countries with percent forestation higher than the United States:

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