# 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[1] in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39,958,245.9[1], a loss of 1,324,449[3], or 3.31[4]%.

The forest area lost over this time period is slightly more than the entire land area of Peru[5] 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 31.11[6]. The region with the highest relative forestation was Latin America & Caribbean[7], 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 32.25[8]. The region with the highest relative forestation was Latin America & Caribbean[7], with 51.03%, and the region with the lowest relative forestation was Middle East & North Africa, with 1.77% forestation.

Table 2.1: Percent Forest Area by Region, 1990 & 2016:[7]

| Region | 1990 Forest Percentage | 2016 Forest Percentage |
|---|---|---|
| East Asia & Pacific | 25.77 | 26.35 |
| Europe & Central Asia | 37.27 | 38.05 |
| Sub-Saharan Africa | 32.18 | 27.55 |

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 (32.19% to 27.55%). 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 32.21% to 31.34%.

# 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. 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, 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. French Polynesia increased in forest area by 27.32% 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 |
| Indonesia | East Asia & Pacific | -282,193.98 |
| Myanmar | East Asia & Pacific | -107,234.0039 |
| Nigeria | Sub-Saharan Africa | -106,506.00098 |
| Tanzania | Sub-Saharan Africa | -102,320 |

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 | -407.25 |
| Nigeria | Sub-Saharan Africa | -261.78 |
| Uganda | Sub-Saharan Africa | -244.67 |
| Mauritania | Sub-Saharan Africa | -187.78 |
| Honduras | Latin America & Caribbean | -181.93 |

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 and 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 and 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 |
|---|---|
| less than 25 | 85 |
| between 25 and 50 | 73 |
| between 50 and 75 | 38 |
| between 75 and 100 | 9 |

The largest number of countries in 2016 were found in the less than 25 quartile.

There were nine 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 | 88.41 |

# 5. RECOMMENDATIONS

- *Write out a set of recommendations as an analyst on the ForestQuery team.*
    - *What have you learned from the World Bank data?*
        - *That the global deforestation entities are neglecting the education of deforestation in many countries that should be much more aware of the devastation that will be caused by deforestation.*
- *Which countries should we focus on over others?*
    - *We should not focus on any country over any other country. All countries need to be treated equally. The main problem appears to be that some of these countries are not receiving any attention. Any country that has a declining forestation should be educated on methods of sustainable forest growth.*

```sql
/* APPENDIX
GLOBAL SITUATION
 */
CREATE VIEW forestation AS
SELECT f.country_code,
       f.year,
       f.country_name,
       r.region,
       l.total_area_sqkm,
       f.forest_area_sqkm,
       (f.forest_area_sqkm / l.total_area_sqkm)*100 AS forest_percent,
       r.income_group,
       CASE
           WHEN (f.forest_area_sqkm / l.total_area_sqkm) * 100 < 25
               THEN 'less than 25'
           WHEN (f.forest_area_sqkm / l.total_area_sqkm) * 100 >= 25
                  AND (f.forest_area_sqkm / l.total_area_sqkm) * 100 < 50
               THEN 'between 25 and 50'
           WHEN (f.forest_area_sqkm / l.total_area_sqkm) * 100 >= 50
                  AND (f.forest_area_sqkm / l.total_area_sqkm) * 100 < 75
               THEN 'between 50 and 75'
           ELSE 'between 75 and 100'
           END AS quartiles
FROM forest_area f
JOIN (
   SELECT country_code,
       country_name,
       year,
       total_area_sq_mi * 2.59 total_area_sqkm
   FROM land_area
   WHERE total_area_sq_mi IS NOT NULL) l
ON f.country_code = l.country_code AND f.year = l.year
JOIN regions r
ON r.country_code = l.country_code
WHERE f.forest_area_sqkm IS NOT NULL AND l.total_area_sqkm IS NOT NULL
ORDER BY country_code, year
```

```sql
/*[1]*/
SELECT country_name, year, forest_area_sqkm
FROM forestation
WHERE (year = 1990 or year = 2016) AND country_name='World'

/*[3]*/
SELECT (SELECT forest_area_sqkm
       FROM forestation
       WHERE year = 1990 AND country_name='World' )-
       (SELECT forest_area_sqkm
       FROM forestation
       WHERE year = 2016 AND country_name='World' ) AS Change_in_time
FROM forestation
LIMIT 1

/*[4]*/
SELECT (((SELECT forest_area_sqkm
       FROM forestation
       WHERE year = 1990 AND country_name='World' )/
       (SELECT forest_area_sqkm
       FROM forestation
       WHERE year = 2016 AND country_name='World' )-1)*100) AS
percent_change_in_time
FROM forestation
LIMIT 1

/*[5]*/
SELECT country_name, total_area_sqkm
FROM forestation
WHERE year = '2016' AND total_area_sqkm < 1324449
ORDER BY total_area_sqkm DESC
LIMIT 1
```

```sql
/*REGIONAL OUTLOOK*/
/*[6]*/
SELECT SUM(f.total_area_sqkm) AS land_total_2016,
   SUM(f.forest_area_sqkm) AS forest_total_2016,
   ROUND(CAST((SUM(f.forest_area_sqkm) * 100 / SUM(f.total_area_sqkm)) AS
   NUMERIC),2) AS forest_percent
FROM (SELECT *
   FROM forestation
   WHERE country_name != 'World') AS f
WHERE year = 2016
/*[7]*/
SELECT f.region,
   sum(forest_area_sqkm)*100/sum(total_area_sqkm) AS percent_1990,
   percent_2016.percent_2016
FROM forestation f
JOIN (SELECT ft.region,
           sum(ft.forest_area_sqkm)*100/sum(ft.total_area_sqkm)
           AS percent_2016
       FROM forestation ft
       WHERE ft.year = 2016 AND ft.forest_percent > 0
           AND ft.region != 'World'
       GROUP BY ft.region) AS percent_2016
ON f.region = percent_2016.region
WHERE year = 1990 AND forest_percent > 0 AND f.region != 'World'
GROUP BY f.region, percent_2016.percent_2016
ORDER BY percent_2016 DESC
/*[8]*/
SELECT SUM(total_area_sqkm) AS land_total_1990,
       SUM(forest_area_sqkm) AS forest_total_1990,
       SUM(forest_area_sqkm) * 100 / SUM(total_area_sqkm) AS
forest_percent
FROM (SELECT *
   FROM forestation
   WHERE country_name != 'World') AS f
WHERE year = 1990
```

```sql
/*COUNTRY-LEVEL DETAIL*/
SELECT f.country_name,
   f.region,
   f.year,
   f.forest_area_sqkm AS forest_area_sqkm_1990,
   forest_area_2016.forest_area_sqkm AS forest_area_sqkm_2016,
   forest_area_2016.forest_area_sqkm - f.forest_area_sqkm AS
   change_over_time
FROM forestation f
JOIN (SELECT ft.forest_area_sqkm, ft.country_name
       FROM forestation ft
       WHERE year = 2016) AS forest_area_2016
ON f.country_name = forest_area_2016.country_name
WHERE f.year = 1990 AND f.forest_area_sqkm > 0
   AND forest_area_2016.forest_area_sqkm > 0
ORDER BY change_over_time DESC

/*Table 3.1: Top 5 Amount Decrease in Forest Area by Country, 1990 &
2016*/
SELECT f.country_name,
region,
f.forest_area_sqkm AS forest_area_sqkm_1990,
forest_area_2016.forest_area_sqkm AS forest_area_sqkm_2016,
forest_area_2016.forest_area_sqkm - f.forest_area_sqkm AS
change_over_time
FROM forestation f
JOIN (SELECT ft.forest_area_sqkm, ft.country_name
FROM forestation ft
WHERE year = 2016) AS forest_area_2016
ON f.country_name = forest_area_2016.country_name
WHERE f.year = 1990
   AND f.forest_area_sqkm IS NOT NULL
   AND forest_area_2016.forest_area_sqkm IS NOT NULL
   AND f.region != 'World'
ORDER BY change_over_time
```

```sql
/*Table 3.2: Top 5 Percent Decrease in Forest Area by Country, 1990 &
2016*/
SELECT f.country_name,
f.region,
f.forest_area_sqkm AS forest_area_sqkm_1990,
forest_area_2016.forest_area_sqkm AS forest_area_sqkm_2016,
ROUND(CAST(((forest_area_2016.forest_area_sqkm - f.forest_area_sqkm) /
forest_area_2016.forest_area_sqkm-1)*100 AS NUMERIC),2) AS
change_over_time
FROM forestation f
JOIN (SELECT *
FROM forestation ft
WHERE year = 2016) AS forest_area_2016
ON f.country_name = forest_area_2016.country_name
WHERE f.year = 1990
AND f.forest_area_sqkm IS NOT NULL
AND forest_area_2016.forest_area_sqkm IS NOT NULL
AND forest_area_2016.forest_percent IS NOT NULL
AND f.forest_percent IS NOT NULL
AND f.region != 'World'
ORDER BY change_over_time
/* [Table 3.3: Count of Countries Grouped by Forestation Percent
Quartiles, 2016] */
SELECT quartiles,
   COUNT(quartiles) AS q_count
FROM forestation
WHERE year = 2016
GROUP BY quartiles
ORDER BY q_count DESC

/* [Table 3.4: Top Quartile Countries, 2016]*/
SELECT *
FROM forestation
WHERE year = 2016 AND quartiles = 'between 75 and 100'
ORDER BY forest_percent DESC
```