

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 **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 sq. KM**, 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 **1279999.9891 sq. KM**).

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%
Sub-Saharan Africa	30.67%	28.79%
East Asia & Pacific	25.78%	26.36%
Europe & Central Asia	37.28%	38.04%
Middle East & North Africa	1.78%	2.07%
North America	35.65%	36.04%
South Asia	16.51%	17.51%
World	32.42%	31.38%

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 **527229.062 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 sq. KM** , much lower than the figure for **China**.

United States and **China** 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 **213.66458%** 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	541510
Indonesia	East Asia & Pacific	282193.9844
Myanmar	East Asia & Pacific	107234.0039
Nigeria	Sub-Saharan Africa	106506.00098
Tanzania	Sub-Saharan Africa	102320

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	61.8
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 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
1	85
2	72
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
American Samoa	East Asia & Pacific	87.5
Gabon	Sub-Saharan Africa	90.04
Guyana	Latin America & Caribbean	83.9
Lao PDR	East Asia & Pacific	82.11
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Palau	East Asia & Pacific	87.61
Seychelles	Sub-Saharan Africa	88.41
Solomon Islands	East Asia & Pacific	77.86
Suriname	Latin America & Caribbean	98.26

4. RECOMMENDATIONS

- *What have you learned from the World Bank data?*
*Deforestation is slowly increasing and its leaving a mark from the period of **1990 to 2016**, the total decrease is **3.21%** which is actually **1324449 sq. KM**. The alarming thing about this is that the total area lost is actually the size of a country **Peru** which is **1279999.9891 sq. KM**. This is alarming because a forestation takes a lot of time in order to build the same area lost due to deforestation.*
- *Which countries should we focus on over others?*
 - *First the attention should be paid to **Nigeria** as it is in the list of top countries which lost the forest area in both absolute and percentage value.*
 - *Secondly, the focus should be on the **Sub-Saharan African** region as this region has 4 out of 5 countries percent decrease in Forest Area by Country.*
 - *Thirdly, the focus should be on individual countries such as **Brazil, Indonesia** and **Myanmar** as they have one of the highest forest area lost.*

5. APPENDIX: SQL Queries Used

****/ Creating a view table first.***

```
CREATE OR REPLACE VIEW forestation
AS
SELECT f.country_code AS forest_cc,
       f.country_name AS f_name,
       f.year AS f_year,
       f.forest_area_sqkm AS f_sq_km,
       l.total_area_sq_mi AS l_total_area_sq_mi,
       r.region AS r_region, r.income_group AS r_income_group,
       (f.forest_area_sqkm/(l.total_area_sq_mi*2.59))*100 AS perc_forest_area
FROM forest_area f
INNER JOIN land_area l
ON f.country_code = l.country_code
INNER JOIN regions r
ON l.country_code = r.country_code
WHERE f.year = l.year ORDER BY 1;
```

****/ Question 1***

Part A

```
SELECT f.forest_area_sqkm
```

```
        FROM forest_area f
WHERE f.country_name = 'World'
AND f.year = 1990;
```

Part B

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

Part C

(Used self join here)

```
SELECT sub1.forest_area_sqkm - sub2.forest_area_sqkm AS diff_forest_area_sq_km
FROM forest_area sub1
JOIN forest_area sub2
ON sub1.country_code = sub2.country_code
WHERE sub1.country_name = 'World'
AND sub1.year = 1990
AND sub2.country_name = 'World'
AND sub2.year = 2016;
```

Part D

(Used self join here)

```
SELECT ((sub1.forest_area_sqkm-sub2.forest_area_sqkm)/sub1.forest_area_sqkm)*100 AS
perc_change_fa
FROM forest_area sub1
JOIN forest_area sub2
ON sub1.country_code = sub2.country_code
WHERE sub1.country_name = 'World'
AND sub1.year = 1990
AND sub2.country_name = 'World'
AND sub2.year = 2016;
```

Part E

```
SELECT l.country_name,
       l.total_area_sq_mi*2.59 AS total_area_sqkm,
       ABS((l.total_area_sq_mi*2.59)- (SELECT sub1.forest_area_sqkm - sub2.forest_area_sqkm
AS diff_forest_area_sq_km
```

```

FROM (SELECT f.country_code AS cc, f.forest_area_sqkm
      FROM forest_area f
      WHERE f.country_name = 'World'
      AND f.year = 1990) AS sub1
INNER JOIN (SELECT f.country_code AS cc, f.forest_area_sqkm
            FROM forest_area f
            WHERE f.country_name = 'World'
            AND f.year = 2016) AS sub2
ON sub1.cc = sub2.cc)) AS diff_fa_la_sqkm

FROM land_area l
WHERE l.year = 2016
ORDER BY 3 LIMIT 1;

```

***/ Question 2**

***/ Creating a view table first.**

```

CREATE OR REPLACE VIEW regional_distr
AS
SELECT r.region,
       l.year,
       SUM(f.forest_area_sqkm) total_forest_area_sqkm,
       SUM(l.total_area_sq_mi*2.59) AS total_area_sqkm,
       (SUM(f.forest_area_sqkm)/SUM(l.total_area_sq_mi*2.59))*100 AS percent_fa_region
FROM forest_area f
INNER JOIN land_area l
ON f.country_code = l.country_code AND f.year = l.year
INNER JOIN regions r
ON l.country_code = r.country_code
GROUP BY 1,2
ORDER BY 1,2;

```

Part A

- What was the percent forest of the entire world in 2016?

```

SELECT ROUND(CAST(percent_fa_region AS numeric),2) AS percent_fa_region
FROM regional_distr
WHERE year = 2016 AND region = 'World';

```

- Which region had the **HIGHEST** percent forest in 2016, and which had the **LOWEST**, to 2 decimal places?

>HIGHEST

```

SELECT region,

```

```

ROUND(CAST(total_area_sqkm AS NUMERIC),2) AS total_area_sqkm,
ROUND(CAST(percent_fa_region AS NUMERIC),2) AS percent_fa_region
FROM regional_distr
WHERE ROUND(CAST(percent_fa_region AS NUMERIC),2) = (SELECT MAX(
                                ROUND(CAST(percent_fa_region AS numeric),2
)) AS max_percent FROM regional_distr WHERE year = 2016 )AND year=2016;

```

> **LOWEST**

```

SELECT region,
ROUND(CAST(total_area_sqkm AS NUMERIC),2) AS total_area_sqkm,
ROUND(CAST(percent_fa_region AS NUMERIC),2) AS percent_fa_region
FROM regional_distr
WHERE ROUND(CAST(percent_fa_region AS NUMERIC),2) = (SELECT MIN(
                                ROUND(CAST(percent_fa_region AS numeric),2 ))
AS max_percent FROM regional_distr WHERE year = 2016)AND year = 2016;

```

Part B

What was the percent forest of the entire world in 1990?

```

SELECT ROUND(CAST(percent_fa_region AS numeric),2) AS percent_fa_region
FROM regional_distr
WHERE year = 1990 AND region = 'World';

```

Which region had the HIGHEST percent forest in 1990, and which had the LOWEST, to 2 decimal places?

```

SELECT region,
ROUND(CAST(total_area_sqkm AS NUMERIC),2) AS total_area_sqkm,
ROUND(CAST(percent_fa_region AS NUMERIC),2) AS percent_fa_region
FROM regional_distr
WHERE ROUND(CAST(percent_fa_region AS NUMERIC),2) = (SELECT MAX(
                                ROUND(CAST(percent_fa_region AS
numeric),2 )) AS max_percent
FROM regional_distr
WHERE year = 1990)
AND year=1990;

```

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

```

SELECT region,

```



```

ROUND(CAST(total_area_sqkm AS NUMERIC),2) AS total_area_sqkm,
ROUND(CAST(percent_fa_region AS NUMERIC),2) AS percent_fa_region
FROM regional_distr
WHERE ROUND(CAST(percent_fa_region AS NUMERIC),2) = (SELECT MIN(
                                ROUND(CAST(percent_fa_region AS
numeric),2)) AS max_percent FROM regional_distr WHERE year = 1990)AND year = 1990;

```

Part C

```

WITH forest_in_1990 AS (SELECT * FROM regional_distr WHERE year =1990 ),
    forest_in_2016 AS (SELECT * FROM regional_distr WHERE year = 2016 )
SELECT forest_in_1990.region,
    ROUND(CAST(forest_in_1990.percent_fa_region AS NUMERIC),2) AS forest_area_1990,
    ROUND(CAST(forest_in_2016.percent_fa_region AS NUMERIC),2) AS forest_area_2016
FROM forest_in_1990
JOIN forest_in_2016
ON forest_in_1990.region = forest_in_2016.region;

```

*/ Question 3

Success stories

- Which country had a increase from year 1990 to 2016?

```

SELECT table1990.country_code,
    table1990.country_name,
    table1990.forest_area_sqkm AS fa_1990_sqkm,
    table2016.forest_area_sqkm AS fa_2016_sqkm,
    table2016.forest_area_sqkm-table1990.forest_area_sqkm AS diff_fa_sqkm
FROM forest_area table1990
JOIN forest_area table2016
ON table1990.country_code = table2016.country_code
WHERE table1990.year = 1990
AND table1990.forest_area_sqkm IS NOT NULL
AND table1990.country_name != 'World'
AND table2016.year = 2016
AND table2016.forest_area_sqkm IS NOT NULL
AND table2016.country_name != 'World'
ORDER BY diff_fa_sqkm desc
Limit 5;

```

- Which country had a highest increase in percentage from year 1990 to 2016 ?

```
SELECT table1990.country_name,  
       100.0*(table2016.forest_area_sqkm-table1990.forest_area_sqkm) /  
       table1990.forest_area_sqkm AS Percent_fa_sqkm  
FROM forest_area table1990  
JOIN forest_area table2016  
ON table1990.country_code = table2016.country_code  
WHERE table1990.year = 1990  
AND table1990.forest_area_sqkm IS NOT NULL  
AND table1990.country_name != 'World'  
AND table2016.year = 2016  
AND table2016.forest_area_sqkm IS NOT NULL  
AND table2016.country_name != 'World'  
ORDER BY Percent_fa_sqkm DESC  
Limit 2;
```

Part A

```
WITH table1990 AS (SELECT f.country_code,  
                          f.country_name,  
                          f.year,  
                          f.forest_area_sqkm  
FROM forest_area f  
WHERE f.year = 1990 AND f.forest_area_sqkm IS NOT NULL AND  
f.country_name != 'World' ),table2016 AS (SELECT f.country_code,  
                          f.country_name,  
                          f.year,  
                          f.forest_area_sqkm  
FROM forest_area f  
WHERE f.year = 2016 AND f.forest_area_sqkm IS NOT NULL AND  
f.country_name != 'World' ) SELECT table1990.country_code,  
table1990.country_name,  
r.region,  
table1990.forest_area_sqkm AS fa_1990_sqkm,  
table2016.forest_area_sqkm AS fa_2016_sqkm,  
table1990.forest_area_sqkm-table2016.forest_area_sqkm AS diff_fa_sqkm  
FROM table1990  
INNER JOIN table2016  
ON table1990.country_code = table2016.country_code  
AND (table1990.forest_area_sqkm IS NOT NULL AND table2016.forest_area_sqkm IS NOT  
NULL)  
INNER JOIN regions r ON table2016.country_code = r.country_code
```

```
ORDER BY 6 DESC
LIMIT 5;
```

Part B

```
WITH table1990 AS (SELECT f.country_code,
                        f.country_name,
                        f.year,
                        f.forest_area_sqkm
                        FROM forest_area f
                        WHERE f.year = 1990 AND f.forest_area_sqkm IS NOT NULL AND
f.country_name != 'World'),
table2016 AS (SELECT f.country_code,
                    f.country_name,
                    f.year,
                    f.forest_area_sqkm
                    FROM forest_area f
                    WHERE f.year = 2016 AND f.forest_area_sqkm IS NOT NULL AND
f.country_name != 'World')
SELECT table1990.country_code,
       table1990.country_name,
       r.region,
       table1990.forest_area_sqkm AS fa_1990_sqkm,
       table2016.forest_area_sqkm AS fa_2016_sqkm,
       table1990.forest_area_sqkm-table2016.forest_area_sqkm AS diff_fa_sqkm,
ABS(ROUND(CAST((((table2016.forest_area_sqkm-table1990.forest_area_sqkm)/table1990.forest_area_sqkm*100) AS NUMERIC),2)) AS perc_change
FROM table1990
INNER JOIN table2016
ON table1990.country_code = table2016.country_code
AND (table1990.forest_area_sqkm IS NOT NULL AND table2016.forest_area_sqkm IS NOT NULL) INNER JOIN regions r ON table2016.country_code = r.country_code
ORDER BY
ROUND(CAST((((table2016.forest_area_sqkm-table1990.forest_area_sqkm)/table1990.forest_area_sqkm*100) AS NUMERIC),2)
LIMIT 5;
```

Part C

```
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 4
            WHEN table1.perc_fa < 75 AND table1.perc_fa >= 50 THEN 3
            WHEN table1.perc_fa < 50 AND table1.perc_fa >=25 THEN 2
            ELSE 1
        END AS percentile
        FROM table1 ORDER BY 5 DESC )
SELECT table2.percentile,
    COUNT(table2.percentile)
FROM table2
GROUP BY 1
ORDER BY 2 DESC;

```

Part D

```

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 4
              WHEN table1.perc_fa < 75 AND table1.perc_fa >= 50 THEN 3
              WHEN table1.perc_fa < 50 AND table1.perc_fa >=25 THEN 2
              ELSE 1
        END AS percentile
        FROM table1 ORDER BY 5 DESC)
SELECT table2.country_name,
       r.region,
       ROUND(CAST(table2.perc_fa AS NUMERIC),2) AS perc_fa,
       table2.percentile
FROM table2
JOIN regions r
ON table2.country_code = r.country_code
WHERE table2.percentile = 4
ORDER BY 1;

```

Part E

```

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)
SELECT COUNT(table1.country_name)
FROM table1
WHERE table1.perc_fa > (SELECT table1.perc_fa
                       FROM table1
                       WHERE table1.country_name = 'United States');

```