

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 km² in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39,958,245.9 km², a loss of 1,324,449 km², or 3.2% decrease.

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 square kilometers)

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 and the Caribbean, with 46.16%, and the region with the lowest relative forestation was the Middle East and 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 and the Caribbean, with 51.03%, and the region with the lowest relative forestation was Middle East and 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 and Caribbean	51.03%	46.16%
Europe and 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 and 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 km². 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 km², much lower than the figure for China.

China and the U.S 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 and Caribbean	541,510 km ²
Indonesia	East Asia and Pacific	282,193.98 km ²
Myanmar	East Asia and Pacific	107,234 km ²
Nigeria	Sub-Saharan Africa	106506 km ²
Tanzania	Sub-Saharan Africa	102,320 km ²

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	59.27%
Mauritania	Sub-Saharan Africa	46.75%
Honduras	Latin America and 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 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 mile 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 bottom or (1st) 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 and Caribbean	98.26
Micronesia, Fed. Sts.	East Asia and Pacific	91.86
Gabon	Sub-Saharan Africa	90.04
Seychelles	Sub-Saharan Africa	88.41
Palau	East Asia and Pacific	87.61
American Samoa	East Asia and Pacific	87.5
Guyana	Latin America and Caribbean	83.9
Lao PDR	East Asia and Pacific	82.11

Solomon Islands	East Asia and Pacific	77.86
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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?*

I learned that many regions in the world are increasing in forest area. For example, Europe and Central Asia, North America, East Asia and the Pacific, South Asia, and Middle East and North Africa are all increasing in forest area and forest area percentage. However, that the world has decreased in forest area from 1990 to 2016 underscores how much forest Latin America and the Caribbean, and Sub-Saharan Africa have lost.

I would recommend focusing on the countries with the largest absolute forest area change, found in table 3.1. The top 5 countries in this category are Brazil, Indonesia, Myanmar, Nigeria, and Tanzania. While looking at countries that have high percentage forestation decrease is useful, I think focusing on the countries that are reducing the most forest by land area is most important. Lastly, I think partnering with China to find best practices for increasing forest area would be very helpful.

Appendix

```
CREATE VIEW Forestation AS
SELECT r.country_name,
       f.year,
       r.income_group,
       r.region,
       l.total_area_sq_mi,
       f.forest_area_sqkm,
       ((Sum(forest_area_sqkm) / Sum(total_area_sq_mi*2.59))*100) percentage_forest
FROM forest_area f
JOIN land_area l ON f.country_code = l.country_code
AND f.year = l.year
JOIN regions r ON r.country_code = f.country_code
GROUP BY r.country_name,
         f.year,
         r.income_group,
         r.region,
         l.total_area_sq_mi,
         f.forest_area_sqkm
```

```
1A) SELECT SUM(forest_area_sqkm) total_forest_area
FROM Forestation
WHERE YEAR = 1990
AND country_name = 'World'
```

```
1B) SELECT SUM(forest_area_sqkm) total_forest_area
FROM forestation
WHERE YEAR = 2016
AND country_name = 'World'
```

```
1C) SELECT (
  (SELECT SUM(forest_area_sqkm) total_forest_area
   FROM Forestation
   WHERE YEAR = 1990
   AND country_name = 'World') -
  (SELECT SUM(forest_area_sqkm) total_forest_area
   FROM forestation
   WHERE YEAR = 2016
   AND country_name = 'World')) AS Difference
FROM Forestation
```

LIMIT 1

```
1D) SELECT (((
    (SELECT SUM(forest_area_sqkm) total_forest_area
    FROM Forestation
    WHERE YEAR = 1990
    AND country_name = 'World') -
    (SELECT SUM(forest_area_sqkm) total_forest_area
    FROM forestation
    WHERE YEAR = 2016
    AND country_name = 'World')) / (
        (SELECT SUM(forest_area_sqkm) total_forest_area
        FROM forestation
        WHERE YEAR = 1990
        AND country_name = 'World')) * 100) AS Percent_decrease
FROM forestation
LIMIT 1
```

```
1E) SELECT country_name,
    SUM(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
```

```
2a) 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) SELECT region,
    Round(((Sum(forest_area_sqkm) / Sum(total_area_sq_mi*2.59))*100)::Numeric, 2) AS
percent_forest
FROM Forestation
WHERE YEAR = 2016
GROUP BY region
ORDER BY percent_forest DESC
```

```

2C) 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)SELECT region,
      Round((((Sum(forest_area_sqkm) / Sum(total_area_sq_mi*2.59))*100)::Numeric,2) AS
percent_forest
FROM Forestation
WHERE YEAR = 1990
GROUP BY region
ORDER BY percent_forest DESC

```

Table 2.1

```

SELECT region,
      Round((((Sum(forest_area_sqkm) / Sum(total_area_sq_mi*2.59))*100)::Numeric, 2) AS
percent_forest
FROM Forestation
WHERE YEAR = 1990
GROUP BY region
ORDER BY percent_forest DESC

```

```

SELECT region,
      Round((((Sum(forest_area_sqkm) / Sum(total_area_sq_mi*2.59))*100)::Numeric, 2) AS
percent_forest
FROM Forestation
WHERE YEAR = 2016
GROUP BY region
ORDER BY percent_forest DESC

```

```

3A)WITH T1 AS
      (SELECT country_name,
            SUM(forest_area_sqkm) forest_area_1
      FROM forestation
      WHERE YEAR = 1990
      GROUP BY country_name,
            forest_area_sqkm),
      T2 AS
      (SELECT country_name,
            SUM(forest_area_sqkm) forest_area_2
      FROM forestation

```



```

WHERE YEAR = 2016
GROUP BY country_name,
        forest_area_sqkm)
SELECT f.country_name,
        (f.forest_area_1 - t.forest_area_2) forest_change
FROM T1 f
JOIN T2 t ON f.country_name = t.country_name
ORDER BY forest_change
LIMIT 2

```

```

3B) WITH T1 AS
    (SELECT country_name,
            (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 percent_forestation_1
    FROM forestation
    WHERE YEAR = 1990
    GROUP BY country_name,
            forest_area_sqkm),
    T2 AS
    (SELECT country_name,
            (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 percent_forestation_2
    FROM forestation
    WHERE YEAR = 2016
    GROUP BY country_name,
            forest_area_sqkm)
SELECT f.country_name,
        Round((((f.percent_forestation_1 -
t.percent_forestation_2)/(f.percent_forestation_1))*100)::Numeric, 2) percent_change
FROM T1 f
JOIN T2 t ON f.country_name = t.country_name
ORDER BY percent_change
LIMIT 1

```

Table 3.1

```

WITH T1 AS
    (SELECT country_name,
            SUM(forest_area_sqkm) forest_area_1
    FROM forestation
    WHERE YEAR = 1990
    GROUP BY country_name,
            forest_area_sqkm),
    T2 AS
    (SELECT country_name,
            SUM(forest_area_sqkm) forest_area_2
    FROM forestation

```

```

WHERE YEAR = 2016
GROUP BY country_name,
        forest_area_sqkm)
SELECT f.country_name,
        (f.forest_area_1 - t.forest_area_2) forest_change
FROM T1 f
JOIN T2 t ON f.country_name = t.country_name
WHERE f.forest_area_1 IS NOT NULL
      AND t.forest_area_2 IS NOT NULL
      AND f.country_name != 'World'
ORDER BY forest_change DESC
LIMIT 5

```

Table 3.2

```

WITH T1 AS
  (SELECT country_name,
          (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 percent_forestation_1
  FROM forestation
  WHERE YEAR = 1990
  GROUP BY country_name,
          forest_area_sqkm),
  T2 AS
  (SELECT country_name,
          (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 percent_forestation_2
  FROM forestation
  WHERE YEAR = 2016
  GROUP BY country_name,
          forest_area_sqkm)
SELECT f.country_name,
        Round((((f.percent_forestation_1 -
t.percent_forestation_2)/(f.percent_forestation_1))*100)::Numeric, 2) percent_change
FROM T1 f
JOIN T2 t ON f.country_name = t.country_name
WHERE f.percent_forestation_1 IS NOT NULL
      AND t.percent_forestation_2 IS NOT NULL
      AND f.country_name != 'World'
ORDER BY percent_change DESC
LIMIT 5

```

3C) Table 3.3

```

WITH T1 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 T1
        WHERE percent_forestation IS NOT NULL
        AND YEAR = 2016) sub

```

Table 3.4

```

WITH T2 AS
(WITH T1 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),
                country_name,
                percent_forestation
        FROM
                (SELECT country_name,
                        percent_forestation,
                        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 T1
WHERE percent_forestation IS NOT NULL
    AND YEAR = 2016) sub)
SELECT country_name,
    quartiles,
    Round(percent_forestation::Numeric, 2) percent_forestation
FROM T2
WHERE quartiles = '75-100'
ORDER BY percent_forestation DESC
```