

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 4,282,694.9 square km in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39,958,245.9, a loss of 1,324,449 square 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 1,279,999.9 square km).

2. REGIONAL OUTLOOK

In 2016, the percent of the total land area of the world designated as forest was 3.38%. 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 31.28%.

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 square 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 State, but it only saw an increase of 79200 square km, much lower than the figure for China.

China and 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 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	51510.00
Indonesia	East Asia & Pacific	282193.98
Myanmar	East Asia & Pacific	107234.00
Nigeria	Sub-Saharan Africa	106506.00
Tanzania	Sub-Saharan Africa	102320.00

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	75.45
Nigeria	Sub-Saharan	61.80
Uganda	Sub-Saharan	5913
Mauritania	Sub-Saharan	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. 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%	72
50%-75%	38
75%-100%	9

The largest number of countries in 2016 were found in the 0%-25% quartile.

There were 85 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	87.50
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 learning World Bank data, the following conclusions can be drawn:

As shown in the study period, globally the world is losing forest areas. The reason for the overall decline is the decline in forest area in Latin America & Caribbean (by 4.87%) and Sub-Saharan Africa (by 1.9%).

We see that the main problems leading to deforestation in Latin America & the Caribbean occurred in Brazil and Honduras as well as in Sub-Saharan Africa, where Togo and Nigeria lead in the rate of deforestation.

Therefore, it is necessary to find out what human actions or what natural phenomena led to the current situation to develop an action plan to improve it.

On the other hand, looking at data on forest change, we see exceptional improvement in two countries: China and the United States. These countries not only did not reduce the area of their forests, but also managed to significantly increase them, especially China. The most significant positive changes have occurred in Iceland. It is necessary to study the experience of these countries and extrapolate it to other countries.

5. APPENDIX: SQL Queries Used

```
DROP VIEW IF EXISTS forestation;
```

```
CREATE VIEW forestation  
AS
```

```
    SELECT f.country_code,  
           f.country_name,  
           f.year,  
           f.forest_area_sqkm,  
           l.total_area_sq_mi,  
           r.region,  
           r.income_group,  
           l.total_area_sq_mi * 2.59
```

```
    AS
```

```
        total_area_sqkm,  
        f.forest_area_sqkm * 100 / ( l.total_area_sq_mi * 2.59
```

```
) AS
```

```
    percent_land_forest
```

```
FROM forest_area f
```

```
LEFT JOIN land_area l
```

```
    ON f.country_code = l.country_code
```

```
    AND f.year = l.year
```

```
LEFT JOIN regions r
```

```
    ON r.country_code = l.country_code;
```

1. GLOBAL SITUATION

```
WITH t1 AS
-- Find square forest 1990 and 2016
(
    SELECT
        (
            SELECT Sum(forest_area_sqkm)
            FROM   forestation
            WHERE  year=1990
            AND    country_name='World') AS forest_1990
        ,
        (
            SELECT Sum(forest_area_sqkm)
            FROM   forestation
            WHERE  year=2016
            AND    country_name='World') AS forest_2016
    )
-
- Find the forest area lost over this time period and in the per
cent and country name
SELECT t1.forest_1990
        AS forest_1990 ,
       t1.forest_2016
        AS forest_2016 ,
       (t1.forest_1990 - t1.forest_2016)
        AS forest_loss_sqkm ,
       Round(((t1.forest_1990 - t1.forest_2016)/t1.forest_1990*1
00)::numeric,2) AS percent_forest_loss ,
       (
           SELECT DISTINCT country_name
           FROM   forestation
           WHERE  total_area_sqkm BETWEEN 1
270000 AND 1350000
           AND    year=2016) AS country_squ
are_equal_loss_forest
FROM   t1;

SELECT total_area_sqkm,
       country_name
FROM   forestation
WHERE  country_name = 'Peru'
GROUP BY 1,
        2;
```

2. REGIONAL OUTLOOK

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

```
SELECT SUM(forest_area_sqkm) * 100 / SUM(total_area_sqkm) AS
      percent_world_forest_2016
FROM   forestation
WHERE  year = 2016
      AND country_name = 'World';

WITH forest_percentage_1990
      AS (SELECT region,
                  Round(( SUM(forest_area_sqkm) * 100 / SUM(total_
area_sqkm) ) ::
                        NUMERIC,
                        2) AS
                  percentage_forest_1990
      FROM   forestation
      WHERE  year = 1990
      GROUP BY 1
      ORDER BY 2 DESC),
      forest_percentage_2016
      AS (SELECT region,
                  Round(( SUM(forest_area_sqkm) * 100 / SUM(total_
area_sqkm) ) ::
                        NUMERIC,
                        2) AS
                  percentage_forest_2016
      FROM   forestation
      WHERE  year = 2016
      GROUP BY 1
      ORDER BY 2 DESC),
      joinded_1990_2016
      AS (SELECT forest_percentage_1990.region,
                  forest_percentage_1990.percentage_forest_1990,
                  forest_percentage_2016.region,
                  forest_percentage_2016.percentage_forest_2016
      FROM   forest_percentage_1990
      JOIN   forest_percentage_2016
            ON forest_percentage_1990.region =
               forest_percentage_2016.region)

SELECT *
FROM   joinded_1990_2016;
```

3. COUNTRY-LEVEL DETAIL

A. SUCCESS STORIES

```
WITH forest_1990
  AS (SELECT country_name,
             SUM(forest_area_sqkm) AS amount_forest_area_1990
       FROM forestation
       WHERE year = 1990
             AND country_name != 'World'
             AND forest_area_sqkm IS NOT NULL
       GROUP BY 1),
forest_2016
  AS (SELECT country_name,
             SUM(forest_area_sqkm) AS amount_forest_area_2016
       FROM forestation
       WHERE year = 2016
             AND country_name != 'World'
             AND forest_area_sqkm IS NOT NULL
       GROUP BY country_name)
SELECT DISTINCT forestation.country_name,
               forestation.region,
               Round(( amount_forest_area_2016 - amount_forest_
area_1990 ) ::
                   NUMERIC, 2) AS
                   absolute_forest_area_change
FROM   forestation
      inner join forest_1990
            ON forestation.country_name = forest_1990.country
_name
      inner join forest_2016
            ON forestation.country_name = forest_2016.country
_name
ORDER BY 3 DESC;

WITH forest_1990 AS
(
  SELECT   country_name,
           Sum(forest_area_sqkm) AS amount_forest_area_19
90
  FROM     forestation
  WHERE    year = 1990
  AND      country_name != 'World'
  AND      forest_area_sqkm IS NOT NULL
  GROUP BY 1), forest_2016 AS
(
  SELECT   country_name,
```



```

Sum(forest_area_sqkm) AS amount_forest_area_20
16
FROM forestation
WHERE year = 2016
AND country_name != 'World'
AND forest_area_sqkm IS NOT NULL
GROUP BY country_name)
SELECT DISTINCT forestation.country_name,
Round(((amount_forest_area_2016 - amount_forest_
area_1990)*100/amount_forest_area_1990)::numeric, 2) AS pct_fore
st_area_change
FROM forestation
INNER JOIN forest_1990
ON forestation.country_name=forest_1990.country_nam
e
INNER JOIN forest_2016
ON forestation.country_name=forest_2016.country_nam
e
ORDER BY 2 DESC limit 5;

```

A. LARGEST CONCERNS

Table 3.1: Top 5 Amount Decrease in Forest Area by Country, 1990 & 2016:

```

WITH forest_1990 AS
(
SELECT country_name,
Sum(forest_area_sqkm) AS amount_forest_area_19
90
FROM forestation
WHERE year = 1990
AND country_name != 'World'
AND forest_area_sqkm IS NOT NULL
GROUP BY 1), forest_2016 AS
(
SELECT country_name,
Sum(forest_area_sqkm) AS amount_forest_area_20
16
FROM forestation
WHERE year = 2016
AND country_name != 'World'
AND forest_area_sqkm IS NOT NULL
GROUP BY country_name)
SELECT DISTINCT forestation.country_name,
region,

```

```

Round((amount_forest_area_1990- amount_forest_ar
ea_2016)::numeric, 2) AS absolute_forest_area_change
FROM      forestation
INNER JOIN forest_1990
ON         forestation.country_name=forest_1990.country_nam
e
INNER JOIN forest_2016
ON         forestation.country_name=forest_2016.country_nam
e
ORDER BY   3 DESC limit 5 ;

```

Table 3.2: Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016:

```

WITH forest_1990 AS
(
    SELECT      country_name,
                Sum(forest_area_sqkm) AS amount_forest_area_19
90
    FROM        forestation
    WHERE       year = 1990
    AND         country_name != 'World'
    AND         forest_area_sqkm IS NOT NULL
    GROUP BY 1), forest_2016 AS
(
    SELECT      country_name,
                Sum(forest_area_sqkm) AS amount_forest_area_20
16
    FROM        forestation
    WHERE       year = 2016
    AND         country_name != 'World'
    AND         forest_area_sqkm IS NOT NULL
    GROUP BY country_name)
SELECT DISTINCT forestation.country_name,
                region,
                Round(((amount_forest_area_1990 - amount_forest_
area_2016)*100/amount_forest_area_1990)::numeric, 2) AS pct_fore
st_area_change
FROM          forestation
INNER JOIN    forest_1990
ON            forestation.country_name=forest_1990.country_nam
e
INNER JOIN    forest_2016
ON            forestation.country_name=forest_2016.country_nam
e
ORDER BY      3 DESC limit 5;

```

A. QUARTILES

Table 3.3: Count of Countries Grouped by Forestation Percent Quartiles, 2016:

```
WITH t1
  AS (SELECT country_name,
             percent_land_forest,
             CASE
               WHEN f.percent_land_forest >= 75 THEN '75%-
100%'
               WHEN f.percent_land_forest >= 50 THEN '50%-
75%'
               WHEN f.percent_land_forest >= 25 THEN '25%-
50%'
               ELSE '0%-25%'
             END AS quartiles
  FROM   forestation f
  WHERE  year = 2016
        AND percent_land_forest IS NOT NULL
        AND country_name != 'World')
SELECT quartiles,
       Count(*)
FROM   t1
GROUP BY quartiles
ORDER BY quartiles;
```

Table 3.4: Top Quartile Countries, 2016:

```
WITH t1
  AS (SELECT country_name,
             region,
             percent_land_forest,
             CASE
               WHEN f.percent_land_forest >= 75 THEN '75%-
100%'
               WHEN f.percent_land_forest >= 50 THEN '50%-
75%'
               WHEN f.percent_land_forest >= 25 THEN '25%-
50%'
               ELSE '0%-25%'
             END AS quartiles
  FROM   forestation f
  WHERE  year = 2016
        AND percent_land_forest IS NOT NULL
        AND country_name != 'World')
```

```

        END AS quartiles
    FROM    forestation f
    WHERE   year = 2016
           AND percent_land_forest IS NOT NULL
           AND country_name != 'World')
SELECT country_name,
       region,
       Round(percent_land_forest :: NUMERIC, 2)
FROM    t1
WHERE   quartiles = '75%-100%'
GROUP BY 1,
        2,
        quartiles,
        percent_land_forest
ORDER BY percent_land_forest DESC;

```

How many countries had a percent forestation higher than the United States in 2016?
 Answer - 109

```

SELECT Row_number()
       OVER(
           ORDER BY percent_land_forest) AS row,
       country_name,
       percent_land_forest
FROM    forestation
WHERE   year = 2016
       AND country_name != 'World'
ORDER BY percent_land_forest;

```