

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 sq.km in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39,958,245.9 sq.km, a loss of 1,324,449 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 1,279,999.9891 sq.km).

2. REGIONAL OUTLOOK

In 2016, the percentage 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 46.14%, and the region with the lowest relative forestation was Middle East & North Africa, with 2.07% forestation.

In 1990, the percentage 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 51.08%, 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	51.08 %	46.14 %
Europe & Central Asia	37.2 %	38.07 %
North America	35.66 %	38.07 %
Sub-Saharan Africa	30.67 %	28.72 %
East Asia & Pacific	25.60 %	26.29 %
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 51.08% to 46.14%) and Sub-Saharan Africa (30.65% to 28.72%). 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 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 79,200 sq.km, 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's forest area increased 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	541,510.00000
Indonesia	East Asia & Pacific	282,193.98440
Myanmar	East Asia & Pacific	107,234.00390
Nigeria	Sub-Saharan Africa	106,506.00098
Tanzania	Sub-Saharan Africa	102,320.00000

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. 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 %	73
50-75 %	38
75-100 %	9

The largest number of countries in 2016 were found in the 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 & Caribbean	98.26 %
Micronesia, Fed. Sts.	East Asia & Pacific	91.86 %
Gabon	Sub-Saharan Africa	91.86 %
Seychelles	Sub-Saharan Africa	88.41 %
Palau	East Asia & Pacific	88.41 %
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 %

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?*

The numbers that I've discovered show that many regions in the world have been enlarging forest areas. North America, Europe, Central Asia, East Asia, the Pacific, Middle East and North Africa are all doing a good job at enlarging forest areas.

Nevertheless, I also discovered that the world has lost forest areas from 1990 to 2016. I can say that because of declining numbers in Latin America, Caribbean, and Sub-Saharan Africa. Countries like Brazil, Indonesia, Myanmar, Nigeria, and Tanzania have the largest loss of the forest areas, so those are the ones who should focus even more on growing more trees.

Also I notice a positive upturn in numbers from China, it seems like they are really putting a lot of effort into growing their forest. So maybe they need to share their tactics and strategies with the world because by the end of the day it's everyone's duty to keep our planet safe.

Appendix

1. Global situation

```
CREATE VIEW forestation_01
AS
SELECT f.country_code, f.country_name, f.year,
       f.forest_area_sqkm,
       l.total_area_sq_mi,
       Round(Cast(f.forest_area_sqkm/(l.total_area_sq_mi * 2.59)*100
AS NUMERIC),2) pct_forest,
       r.region, r.income_group
FROM forest_area f
INNER JOIN land_area l
ON f.country_code = l.country_code AND f.year = l.year
JOIN regions r
ON l.country_code = r.country_code
```

a. What was the total forest area (in sq. km) of the world in 1990? Please keep in mind that you can use the country record denoted as “World” in the region table.

```
SELECT country_name, forest_area_sqkm
FROM forestation_01
WHERE country_name = 'World' AND year = 1990
```

b. What was the total forest area (in sq. km) of the world in 2016? Please keep in mind that the country record in the table is denoted as “World.”

```
SELECT country_name, forest_area_sqkm
FROM forestation_01
WHERE country_name = 'World' AND year = 2016
```

c. What was the change (in sq. km) in the forest area of the world from 1990 to 2016?

```
WITH yr1990 AS(  
    SELECT country_name, forest_area_sqkm  
    FROM forestation_01  
    WHERE country_name = 'World' AND year = 1990),  
yr2016 AS (  
    SELECT country_name, forest_area_sqkm  
    FROM forestation_01  
    WHERE country_name = 'World' AND year = 2016)  
SELECT a.forest_area_sqkm - b.forest_area_sqkm AS diff_sq_km  
FROM yr1990 a  
INNER JOIN yr2016 b  
ON a.country_name = b.country_name
```

d. What was the percent change in forest area of the world between 1990 and 2016?

```
WITH yr1990 AS(  
    SELECT*  
    FROM forestation_01  
    WHERE country_name = 'World' AND year = 1990),  
yr2016 AS (  
    SELECT *  
    FROM forestation_01  
    WHERE country_name = 'World' AND year = 2016)  
SELECT (a.forest_area_sqkm -  
b.forest_area_sqkm)/a.forest_area_sqkm*100 AS pct_diff_sqkm  
FROM yr1990 a  
JOIN yr2016 b  
ON a.country_code=b.country_code
```

e. If you compare the amount of forest area lost between 1990 and 2016, to which country's total area in 2016 is it closest to?

```
SELECT country_name,
       total_area_sq_mi *2.59 AS total_area_sqkm
FROM forestation_01
WHERE year = 2016 AND country_name != 'World' AND
       total_area_sq_mi *2.59 <= (
       SELECT v1.forest_area_sqkm - v2.forest_area_sqkm
       world_deforestation
       FROM (SELECT country_name, forest_area_sqkm
       FROM forestation_01
       WHERE country_name = 'World' AND year =1990) v1
       JOIN (SELECT country_name, forest_area_sqkm
       FROM forestation_01
       WHERE country_name = 'World' AND year =2016) v2
       ON v1.country_name = v2.country_name)
ORDER BY 2 DESC
LIMIT 1
```


2 REGIONAL OUTLOOK

a. What was the percent forest of the entire world in 2016?

```
SELECT country_name, year, pct_forest
FROM forestation_01
WHERE country_name = 'World' AND year = 2016
```

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

```
WITH a1 AS(
    SELECT region, year,
    Round(Cast(Sum(forest_area_sqkm)/Sum(total_area_sq_mi * 2.59)* 100 AS
    NUMERIC),2) pct_forest_regions
FROM forestation_01
WHERE region != 'World' AND year = 2016
GROUP BY 1,2)
SELECT region, pct_forest_regions
FROM a1
WHERE pct_forest_regions = ( SELECT Max(pct_forest_regions) FROM a1)
UNION
SELECT region, pct_forest_regions
FROM a1
WHERE pct_forest_regions = ( SELECT Min(pct_forest_regions) FROM a1)
```

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

```
SELECT country_name, year, pct_forest
FROM forestation_1
WHERE country_name = 'World' AND year = 1990
```

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

```
with a1 AS(
  SELECT region, year,
    round(cast(SUM(forest_area_sqkm)/SUM (total_area_sq_mi
*2.59)* 100 AS NUMERIC),2) pct_forest_regions
  FROM forestation_1
  WHERE region != 'World' AND year = 1990
  GROUP BY 1,2)
SELECT region, pct_forest_regions
FROM a1
WHERE pct_forest_regions = ( SELECT max(pct_forest_regions) FROM a1)
UNION
SELECT region, pct_forest_regions
FROM a1
WHERE pct_forest_regions = ( SELECT min(pct_forest_regions) FROM a1)
WHERE rank IN (1,8)
```

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

```
WITH region_2016 AS (  
    SELECT region ,  
           Round(Cast(Sum(forest_area_sqkm) / Sum(total_area_sq_mi * 2.59) *  
100 AS NUMERIC),2) AS pct_forest  
    FROM forestation_01  
    WHERE year = 2016 AND region != 'World'  
    GROUP BY 1),  
region_1990 AS (  
    SELECT region ,  
           Round(Cast(Sum(forest_area_sqkm) / Sum(total_area_sq_mi * 2.59) *  
100 AS NUMERIC),2) AS pct_forest  
    FROM forestation_01  
    WHERE year = 1990 AND region != 'World'  
    GROUP BY 1)  
SELECT a.region "Region",  
       b.pct_forest AS "1990 Forest Percentage",  
       a.pct_forest AS "2016 Forest Percentage",  
       CASE WHEN b.pct_forest > a.pct_forest THEN 'Decrease'  
       ELSE 'Increase' END AS "Change in Region Forest Percentage"  
FROM region_2016 a  
JOIN region_1990 b  
ON a.region = b.region
```

3 COUNTRY LEVEL-DETAILS

a. Which 5 countries saw the largest amount decrease in forest area from 1990 to 2016? What was the difference in forest area for each?

```
with forest_1990 AS (  
  SELECT country_name,  
         region ,  
         forest_area_sqkm  
  FROM forestation_01  
  WHERE year = 1990 AND country_name != 'World'  
  AND forest_area_sqkm IS NOT NULL  
) ,  
forest_2016 AS (  
  SELECT country_name,  
         region ,  
         forest_area_sqkm  
  FROM forestation_01  
  WHERE year = 2016 AND country_name != 'World'  
  AND forest_area_sqkm IS NOT NULL  
)  
SELECT a.country_name AS "Country",  
       b.region AS "Region",  
       a.forest_area_sqkm - b.forest_area_sqkm AS "Absolute Forest Area Change"  
FROM forest_1990 a  
JOIN forest_2016 b  
ON a.country_name = b.country_name AND a.region = b.region  
ORDER BY 3 DESC  
limit 5
```

c. If countries were grouped by percent forestation in quartiles, which group had the most countries in it in 2016?

```
CASE  
WHEN pct_forest <= 25 THEN '0-25%'  
WHEN pct_forest <= 50 AND pct_forest > 25 THEN '25-50%'  
WHEN pct_forest <= 75 AND pct_forest > 50 THEN '50-75%'  
ELSE '75-100%'  
END AS quartiles FROM forestation_01  
WHERE pct_forest IS NOT NULL  
AND pct_forest = 2016 AND country_name != 'World'  
SELECT DISTINCT( quartiles ), COUNT(country)  
  OVER(PARTITION BY quartiles)  
FROM sub
```

d. List all the countries that were in the 4th quartile (percent forest > 75%) in 2016

```
SELECT country_name AS "Country",  
       region AS "Region",  
       pct_forest AS "Pct Designated as Forest"  
FROM forestation_01  
WHERE year = 2016 AND pct_forest > 75  
ORDER BY 3 DESC
```

e. How many countries had a percent forestation higher than the United States in 2016?

```
SELECT Count(*) pct_forest_above_us  
FROM forestation_01  
WHERE year = 2016 AND pct_forest IS NOT NULL AND  
pct_forest > (SELECT pct_forest  
              FROM forestation_01  
              WHERE year= 2016 AND country_name ='United States')
```