

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 km²** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9 km²**, a loss of **1324449 km²**, 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 km²**).

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 **46.16%**, 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 **28.78%**). 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 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 **79200 km²**, 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** increased in forest area by **313.66%** 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	-541510.00
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 Africa	-75.45
Nigeria	Sub-Saharan Africa	-61.80
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
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 **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	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

Write out a set of recommendations as an analyst on the ForestQuery team.

- *What have you learned from the World Bank data?*

According to World Bank data, total forest areas worldwide decreased by 3.21% between 1990 and 2016, resulting in a loss of 1,324,449 square kilometers, an area slightly larger than Peru. The regions experiencing the most significant percentage declines in forest cover are Sub-Saharan Africa and Latin America & the Caribbean.

- *Which countries should we focus on over others?*

Sub-Saharan Africa is home to the top four countries with the highest percentage decreases in forestation: Togo (-75.45%), Nigeria (-61.80%), Uganda (-59.13%), and Mauritania (-46.75%). In Latin America & the Caribbean, Honduras has witnessed a notable -45.03% decline, while Brazil has lost 541,510 square kilometers of forest cover. These countries require immediate reforestation efforts to combat deforestation.

To guide effective reforestation strategies, we can draw inspiration from countries that have successfully increased their forest cover. China, for instance, has achieved a remarkable increase of 527,229 square kilometers of forested land, while Iceland has witnessed a staggering 313.66% growth in its forest area. Analyzing the policies and practices implemented by these success stories can provide valuable insights for replicating their achievements in other regions.

5. APPENDIX: SQL Queries Used

0) Create a forestation view query

```
-- Create a forestation view query that joins all three tables on the columns
-- indicated, and creates a new column by performing a calculation that compares
-- two columns.
CREATE VIEW forestation AS
SELECT fa.country_code, fa.country_name, fa.year, fa.forest_area_sqkm,
       -- sqmi to sqkm conversion
       la.total_area_sq_mi*2.59 total_area_sqkm,
       -- forest area percentage
       (fa.forest_area_sqkm/(la.total_area_sq_mi*2.59))*100 forest_percentage,
       rg.region, rg.income_group
FROM forest_area fa
INNER JOIN land_area la
    ON fa.country_code=la.country_code
   AND fa.year=la.year
INNER JOIN regions rg
    ON fa.country_code=rg.country_code;
-- Select all columns
SELECT *
FROM forestation;
```

1) Global Situation

```
-- 1) GLOBAL SITUATION
-- 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.
-- b. What was the total forest area (in sq km) of the world in 2016? Please
-- keep in mind that you can use the country record in the table is denoted as
-- "World."
SELECT year, forest_area_sqkm
FROM forestation
WHERE (year=1990 or year=2016) AND country_name='World';

-- c. What was the change (in sq km) in the forest area of the world from 1990
-- to 2016?
SELECT (pres.forest_area_sqkm - past.forest_area_sqkm) diff
FROM forestation pres, forestation past
WHERE pres.year=2016 AND past.year=1990
   AND pres.country_name='World' AND past.country_name='World';

-- d. What was the percent change in forest area of the world between 1990 and
-- 2016?
SELECT (pres.forest_area_sqkm-past.forest_area_sqkm)/ past.forest_area_sqkm*100 percent_change
FROM forestation pres, forestation past
WHERE pres.year=2016 AND past.year=1990
   AND pres.country_name='World' AND past.country_name='World';

-- 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_sqkm
FROM forestation
WHERE year=2016 AND total_area_sqkm<1324449
ORDER BY total_area_sqkm DESC
LIMIT 1;
```

2) Regional Outlook

```
-- 2) REGIONAL OUTLOOK
-- Create a table that shows the Regions and their percent forest area (sum of
-- forest area divided by the sum of land area) in 1990 and 2016. (Note that 1
-- sq mi = 2.59 sq km).
CREATE VIEW regional_forestation AS
SELECT f.region, f.year,
       SUM(f.forest_area_sqkm)/SUM(f.total_area_sqkm)*100 percent_forest_area
FROM forestation f
GROUP BY 1,2
ORDER BY 1,2;
-- Select all columns
SELECT *
FROM regional_forestation;

-- a. What was the percent forest of the entire world in 2016? Which region had
-- the HIGHEST percent forest in 2016, and which had the LOWEST, to 2 decimal places?
-- b. What was the percent forest of the entire world in 1990? Which region had
-- the HIGHEST percent forest in 1990, and which had the LOWEST, to 2 decimal places?
-- c. Based on the table you created, which regions of the world DECREASED in
-- forest area from 1990 to 2016?
SELECT pres.region,
       ROUND(CAST(pres.percent_forest_area AS numeric),2) percent_fa_2016,
       ROUND(CAST(past.percent_forest_area AS numeric),2) percent_fa_1990
FROM regional_forestation pres, regional_forestation past
WHERE pres.year=2016 AND past.year=1990
      AND pres.region=past.region
ORDER BY percent_fa_2016 DESC;
```

3) Country-Level Detail

```
-- 3) COUNTRY-LEVEL DETAIL
-- 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?
SELECT pres.country_name,
       pres.forest_area_sqkm-past.forest_area_sqkm difference
FROM forestation pres
INNER JOIN forestation past
ON (pres.year=2016 AND past.year=1990)
   AND pres.country_name=past.country_name
   AND pres.forest_area_sqkm-past.forest_area_sqkm>0
ORDER BY difference DESC
LIMIT 5;

-- b. Which 5 countries saw the largest percent decrease in forest area from
-- 1990 to 2016? What was the percent change to 2 decimal places for each?
SELECT pres.country_name,pres.region,
       ROUND(CAST(pres.forest_area_sqkm/past.forest_area_sqkm*100 AS numeric),2) percent_increase
FROM forestation pres
INNER JOIN forestation past
ON (pres.year=2016 AND past.year=1990)
   AND pres.country_name!='World'
   AND pres.country_name=past.country_name
   AND pres.forest_area_sqkm/past.forest_area_sqkm>0
ORDER BY percent_increase DESC
LIMIT 5;
```

```

-- Table 3.1: Top 5 Amount Decrease in Forest Area by Country, 1990 & 2016:
SELECT pres.country_name,pres.region,
       ROUND(CAST(pres.forest_area_sqkm-past.forest_area_sqkm AS numeric),2) difference
FROM forestation pres
INNER JOIN forestation past
  ON (pres.year=2016 AND past.year=1990)
   AND pres.country_name!='World'
   AND pres.country_name=past.country_name
ORDER BY difference
LIMIT 5;

-- Table 3.2: Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016:
SELECT pres.country_name,pres.region,
       ROUND(CAST((pres.forest_area_sqkm/past.forest_area_sqkm-1)*100 AS numeric),2) percent_decrease
FROM forestation pres
INNER JOIN forestation past
  ON (pres.year=2016 AND past.year=1990)
   AND pres.country_name!='World'
   AND pres.country_name=past.country_name
ORDER BY percent_decrease
LIMIT 5;

-- c. If countries were grouped by percent forestation in quartiles, which group
-- had the most countries in it in 2016?
SELECT distinct(quartile_group), COUNT(country_name) OVER (PARTITION BY quartile_group) AS county_count
FROM (SELECT country_name,
             CASE
               WHEN forest_percentage < 25 THEN '0-25%'
               WHEN forest_percentage >= 25
                AND forest_percentage < 50 THEN '25-50%'
               WHEN forest_percentage >= 50
                AND forest_percentage < 75 THEN '50-75%'
               ELSE '75-100%'
             END AS quartile_group
      FROM forestation
      WHERE year=2016 AND country_name!='World'
      AND forest_percentage IS NOT NULL) q;

```

```

-- d. List all of the countries that were in the 4th quartile (percent forest > 75%) in 2016.
SELECT country_name, region, ROUND(CAST(forest_percentage as numeric),2) forest_percentage
FROM forestation
WHERE year=2016 AND forest_percentage>75
ORDER BY forest_percentage DESC;

-- e. How many countries had a percent forestation higher than the United States in 2016?
WITH table1 AS
  (SELECT country_name, year, forest_percentage
   FROM forestation
   WHERE year=2016 AND country_name!='World'
     AND forest_percentage IS NOT NULL
   ORDER BY forest_percentage DESC)
SELECT COUNT(t1.country_name)
FROM table1 t1
WHERE t1.forest_percentage>(SELECT t1.forest_percentage
                          FROM table1 t1
                          WHERE t1.country_name='United States');

```