

# 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 (PER) listed for the year 2016 (which is 1279999.99 sq. km).

## 2. REGIONAL OUTLOOK

In 2016, the percentage of the total land area of the world designated as forest was 31.37 %. The region with the highest relative forestation was East Asia & Pacific, with 50.9%, and the region with the lowest relative forestation was Middle East & North Africa, with 31.9% 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 East Asia & Pacific, with 47.38%, and the region with the lowest relative forestation was Middle East & North Africa, with 2.70% forestation.

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

Region	1990 Forest Percentage	2016 Forest Percentage
East Asia & Pacific	47.38	50.9
Latin America & Caribbean	43.34	41.64
Sub-Saharan Africa	35.26	31.28
North America	29.94	30.20
Europe & Central Asia	26.32	28.30
South Asia	20.67	21.60
Middle East & North Africa	2.69	3.20

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Latin America & Caribbean (dropped from 43.34 % to 41.64 %) and Sub-Saharan Africa (35.26 % to 31.28 %). 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 31.37 %.

### 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 527229.06 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.

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 75.83% 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	-282193.98
Myanmar	Eas Asia & Pacific	-107234.00
Nigeria	Sub-Saharan Africa	-106506.00
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	-75.44
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 kilometre 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
4	9
3	38
2	73
1	85

The largest number of countries in 2016 were found in the 1 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

- Percentage of loss of forest designated area from 1990 to 2016 seems to be really small in percentage (which is only 3.20 %), but if we compare it with a country, we have lost more forest area than land area of Peru.
- Afforestation efforts should be more focused towards Sub Saharan Africa, and Latin America and Caribbean regions because these regions have lost a huge amount of forest area.
- Rapid Afforestation programs should be initiated in Brazil which lost 541510 sq. km of forest area and Brazil is considered as “Lungs of the Mother Earth”.
- Nigeria is a severely deforested country in Sub Saharan Africa because it lost 106506 sq. km of forest land between 1990 and 2016. Other critical countries to focus in Sub-Saharan-Area are Togo, Uganda, Mauritania, Tanzania and Honduras. In overall Sub Saharan African region has lost 3.98% of its forest area and four of its countries are under “Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016” list.
- East Asia and Pacific region show an increase in forest area by 2.71% between 1990 and 2016, however two of its countries Indonesia and Myanmar are ranked 2nd and 3rd respectively in “Absolute Forest Area Change in sq. km” list. Both countries encounter climate disaster quite frequently which can be one of the reasons for this opposite trend between region and its country deforestation.
- We can approach the forest authorities of China, USA, and India for guidance for our afforestation program because these countries performed extremely well in increasing the forest area in between 2016 and 2019 and specially China which shows significant progress of 527229 sq. km increase in forest area.
- To maintain this forest; we should approach countries which lie in quartile 4 of the ratio of forest to land area (as shown in table 3.4) such as Suriname and Micronesia Fed. Sts.

## 5. APPENDIX

Here is a list of the questions and the queries formed and executed to get the answer.

### CREATING THE VIEW

```
-- Checking if the view already exists and deleting it if it does
DROP VIEW IF EXISTS forestation;
-- Creating the view
CREATE VIEW forestation AS
SELECT f.country_code AS country_code,
       f.country_name AS country_name,
       f.year,
       f.forest_area_sqkm AS forest_area_sq_km,
       l.total_area_sq_mi*2.59 AS land_area_sq_km,
       r.region,
       r.income_group,
       (f.forest_area_sqkm*100)/(l.total_area_sq_mi*2.59) AS
per_forest_area_sqkm
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;
```

---

1. 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 SUM(forest_table.forest_area_sq_km)
FROM forestation forest_table
WHERE forest_table.year = 1990
and forest_table.country_name = 'World'
```

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2. What was the total forest area (in sq km) of the world in 2016? Please keep in mind that

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*you can use the country record in the table is denoted as "World."\*/*

```
SELECT SUM(forest_table.forest_area_sq_km)
FROM forestation forest_table
WHERE forest_table.year = 2016
and forest_table.country_name = 'World'
```

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

```
SELECT
    (SELECT SUM(forest_area_sq_km)
     FROM forestation
     WHERE YEAR = 1990 and COUNTRY_NAME = 'World') -
    (SELECT SUM(forest_area_sq_km)
     FROM forestation
     WHERE YEAR = 2016 AND COUNTRY_NAME = 'World') As
    per_of_change_in_area
```

---

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

```
WITH forest_area_1990 AS
    (SELECT SUM(forest_table.forest_area_sq_km)
     FROM forestation forest_table
     WHERE forest_table.year = 1990),

change_in_forest_area AS
    (SELECT MIN(
        (SELECT SUM(forest_area_sq_km)
         FROM forestation
         WHERE YEAR = 1990) -
        (SELECT SUM(forest_area_sq_km)
         FROM forestation
         WHERE YEAR = 2016)) AS per_of_change_in_area
     FROM forestation)
SELECT MIN(
    (SELECT *
     FROM change_in_forest_area)*100/
    (SELECT *
     FROM forest_area_1990)) AS per_of_change_in_area
FROM forestation;
```

6. 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?

```
WITH change_in_forest_area AS
  (SELECT MIN(
    (SELECT SUM(forest_area_sq_km)
     FROM forestation
     WHERE YEAR = 1990) -
    (SELECT SUM(forest_area_sq_km)
     FROM forestation
     WHERE YEAR = 2016)) AS per_of_change_in_area
  FROM forestation)
SELECT *
FROM forestation f
WHERE YEAR = 2016
ORDER BY ABS(f.land_area_sq_km -
  (SELECT *
   FROM change_in_forest_area))
LIMIT 1;
```

---

7. Regional Outlook - 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.

```
SELECT SUM(forest_area_sq_km*100)/(SUM(land_area_sq_km)) AS
percent_of_forest
FROM forestation f
WHERE YEAR = 2016;

SELECT region,
  ROUND(CAST(AVG(per_forest_area_sqkm) AS NUMERIC),2) AS
forest_area
FROM forestation
WHERE YEAR = 2016
  AND per_forest_area_sqkm IS NOT NULL
GROUP BY 1
ORDER BY 2 DESC;
```



8. 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 region,
       ROUND(CAST((SUM(forest_area_sq_km)*100)/(SUM(land_area_sq_km))
AS NUMERIC),2) AS percent_of_forest
FROM forestation f
WHERE YEAR = 2016
      AND per_forest_area_sqkm IS NOT NULL
GROUP BY 1
ORDER BY 2 DESC;
```

---

9. COUNTRY-LEVEL DETAIL. Which 5 countries saw the largest amount decrease in forest area from 1990 to 2016?

```
WITH forest_1990 AS
  (SELECT country_code,
         YEAR,
         country_name,
         forest_area_sq_km
   FROM forestation
   WHERE YEAR = 1990),
  forest_2016 AS
  (SELECT country_code,
         YEAR,
         country_name,
         forest_area_sq_km
   FROM forestation
   WHERE YEAR = 2016)
SELECT f16.country_code,
       f16.country_name,
       f90.year AS year_1990,
       f16.year AS year_2016,
       f90.forest_area_sq_km AS forest_1990,
       f16.forest_area_sq_km AS forest_2016,
       ROUND(CAST((f16.forest_area_sq_km - f90.forest_area_sq_km) AS
NUMERIC),2) AS change_in_forest_area
FROM forest_1990 f90
JOIN forest_2016 f16 ON f90.country_code = f16.country_code
AND f90.country_name = f16.country_name
WHERE (f90.forest_area_sq_km IS NOT NULL)
      AND (f16.forest_area_sq_km IS NOT NULL)
      AND (f16.country_name ≠ 'World')
ORDER BY 7
LIMIT 5;
```

10. COUNTRY-LEVEL DETAIL. 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?

```
WITH forest_1990 AS
  (SELECT country_code,
    YEAR,
    country_name,
    forest_area_sq_km
  FROM forestation
  WHERE YEAR = 1990),
forest_2016 AS
  (SELECT country_code,
    YEAR,
    country_name,
    forest_area_sq_km
  FROM forestation
  WHERE YEAR = 2016)
SELECT f16.country_code,
  f16.country_name,
  f90.year AS year_1990,
  f16.year AS year_2016,
  f90.forest_area_sq_km AS forest_1990,
  f16.forest_area_sq_km AS forest_2016,
  (f16.forest_area_sq_km - f90.forest_area_sq_km) AS
change_in_forest_area,
  ROUND(CAST((f16.forest_area_sq_km -
f90.forest_area_sq_km)*100/(f90.forest_area_sq_km) as NUMERIC),2) AS
per_change_in_forest_area_sqkm
FROM forest_1990 f90
JOIN forest_2016 f16 ON f90.country_code = f16.country_code
AND f90.country_name = f16.country_name
WHERE (f90.forest_area_sq_km IS NOT NULL)
  AND (f16.forest_area_sq_km IS NOT NULL)
  AND (f16.country_name ≠ 'World')
ORDER BY 8
LIMIT 5;
```

11. COUNTRY-LEVEL DETAIL. If countries were grouped by percent forestation in quartiles, which group had the most countries in it in 2016?

```
SELECT DISTINCT(quartiles),  
       COUNT(country_name) OVER (PARTITION BY quartiles)  
FROM  
  (SELECT country_name,  
         CASE  
           WHEN per_forest_area_sqkm ≤ 25 THEN 1  
           WHEN per_forest_area_sqkm > 25  
             AND per_forest_area_sqkm ≤ 50 THEN 2  
           WHEN per_forest_area_sqkm > 50  
             AND per_forest_area_sqkm ≤ 75 THEN 3  
           ELSE 4  
         END AS quartiles  
  FROM forestation  
  WHERE YEAR = 2016  
        AND (per_forest_area_sqkm IS NOT NULL)) t1;
```

12. COUNTRY-LEVEL DETAIL. List all of the countries that were in the 4th quartile (percent forest > 75%) in 2016.

```
SELECT country_name,  
       ROUND(CAST(per_forest_area_sqkm AS NUMERIC),2)  
FROM forestation  
WHERE YEAR = 2016  
      AND (per_forest_area_sqkm IS NOT NULL)  
      AND (per_forest_area_sqkm > 75)  
ORDER BY 2 DESC;
```

13. COUNTRY-LEVEL DETAIL. How many countries had a percent forestation higher than the United States in 2016?

```
SELECT COUNT(*) AS num_countries
FROM
  (SELECT per_forest_area_sqkm AS other
   FROM forestation
   WHERE YEAR = 2016
     AND (per_forest_area_sqkm IS NOT NULL)
     AND (country_name NOT LIKE 'United States')) t1
WHERE
  (SELECT per_forest_area_sqkm AS usa
   FROM forestation
   WHERE YEAR = 2016
     AND (per_forest_area_sqkm IS NOT NULL)
     AND (country_name LIKE 'United States')) < t1.other
```