

# 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 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, 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 1279999.99).

## 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 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
Sub-Saharan Africa	30.67	28.79
Europe & Central Asia	37.28	38.04
East Asia & Pacific	25.78	26.36
South Asia	16.51	17.51
Middle East & North Africa	1.78	2.07
North America	35.65	36.04
World	32.42	31.38

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 31.38%.

### 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. 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, much lower than the figure for China.

India and Russian Federation 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	541510
Indonesia	East Asia & Pacific	282194
Myanmar	East Asia & Pacific	107234
Nigeria	Sub-Saharan Africa	106506
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	75.45
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 1<sup>ST</sup> 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	87.5
Guyana	Latin America & Caribbean	83.9
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?*
- *Which countries should we focus on over others?*

The given data, which was between 1990 and 2016, it is easy to see that total forest area of the world had been slightly shrunk from 41,282,694.9 to 39,958,245.9, which is a loss of 1,324,449. Whereas some countries have increased forest area while several states have witnessed a loss.

I believe the country, China, which have an outstanding change over years, should be our role model for those who had decreased in forest area awfully, among countries. China had increased its total forest area by 527,229.06, from 1990 to 2016. Another fact which is worth to consider when we look at the top 5 percent decrease in forest area by country is that the region of Sub-Saharan Africa has been leading the list with its countries and those countries had lost more than half of their forest area.

## 5. APPENDIX: SQL Queries Used

### PART 1

```
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,100*f.forest_area_sqkm/(l.total_area_sq_mi*2.59) as percent_of_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
AND r.country_code=l.country_code
```

1.1 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 forest_area_sqkm
FROM forestation
WHERE country_name = 'World'
AND year = 1990
```

1.2 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 forest_area_sqkm
FROM forestation
WHERE country_name = 'World'
AND year = 2016
```

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

```
WITH forest_2016 AS (select country_name as c1, forest_area_sqkm as f16
FROM forestation
WHERE
country_name = 'World'
AND year = 2016),
forest_1990 AS (SELECT country_name AS c2,forest_area_sqkm AS f90
FROM forestation
WHERE
country_name = 'World'
AND year = 1990)
SELECT f16-f90
FROM forest_2016 f1
JOIN forest_1990 f2
ON f1.c1 = f2.c2
```

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

```
WITH forest_2016 AS (SELECT country_name AS c1, forest_area_sqkm AS f16
FROM forestation
WHERE
country_name = 'World'
AND year = 2016),
forest_1990 AS (select country_name AS c2,forest_area_sqkm AS f90
FROM forestation
WHERE
country_name = 'World'
AND year = 1990)
SELECT 100*(f16-f90)/f90
FROM forest_2016 f1
```

```
JOIN forest_1990 f2
ON f1.c1 = f2.c2
```

1.5 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 t1,
ABS((SELECT forest_area_sqkm
FROM forestation
WHERE
country_name = 'World'
AND year = 2016) - (SELECT forest_area_sqkm
FROM forestation
WHERE country_name = 'World'
AND year = 1990)) AS t_lost,
ABS(total_area_sq_mi*2.59 -ABS(
(SELECT forest_area_sqkm
FROM forestation
WHERE country_name = 'World'
AND year = 2016) - (SELECT forest_area_sqkm
FROM forestation
WHERE country_name = 'World'
AND year = 1990))) AS diffs
FROM forestation
WHERE year = 2016
ORDER BY 4
LIMIT 1
```

## PART 2 (ALL TOGETHER)

2. Create a table that shows the Regions and their percent forest area (sum of forest area divided by sum of land area) in 1990 and 2016. (Note that 1 sq mi = 2.59 sq km).  
Based on the table you created, ....

- 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?

```

WITH forest_percentage_1990 AS (SELECT region AS region1,(SUM(forest_area_sqkm) * 100)
/ (SUM(total_area_sq_mi)*2.59 ) AS fper1990
    FROM forestation
    WHERE year = 1990
    GROUP BY 1),
forest_percentage_2016 AS (SELECT region AS region2,(SUM(forest_area_sqkm) * 100) /
(SUM(total_area_sq_mi)*2.59 ) AS fper2016
    FROM forestation
    WHERE year = 2016
    GROUP BY 1),
joined_1990_2016 AS ( SELECT Region1,fper1990,fper2016
    FROM forest_percentage_1990 f19
    JOIN forest_percentage_2016 f20
    ON f19.region1 = f20.region2)
SELECT Region1,ROUND(fper1990 :: numeric,2) AS f_p_1990,ROUND(fper2016 :: numeric,2)
AS f_p_2016
FROM joined_1990_2016

```

### PART 3

3.1 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 c16 AS (select country_name AS c1,region as reg1,forest_area_sqkm AS f16
    FROM forestation
    WHERE year = 2016),
c90 AS
    (SELECT country_name AS c2,region as reg2,forest_area_sqkm AS f90
    FROM forestation

```



```

WHERE year = 1990)
SELECT c1,reg1,(f16-f90) AS decr
FROM c16
JOIN c90
ON c16.c1 = c90.c2
ORDER BY decr

```

3.2 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 c16 as (select region as rr,country_name as c1,forest_area_sqkm as f16
              from forestation
              where year = 2016),
c90 as
  (select country_name as c2,forest_area_sqkm as f90
   from forestation
   where year = 1990)
select rr,c1,round(((100*(f16-f90)/f90) :: numeric,2) as decr
from c16
join c90
on c16.c1 = c90.c2
order by decr

```

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

```

WITH c16 AS (SELECT country_name AS c1,year as y1,percent_of_forest AS f16
             FROM forestation
             WHERE year = 2016
            )
SELECT count(c1), case
      WHEN f16>=75 THEN '4th_q'
      WHEN f16>=50 AND f16<75 THEN '3rd_q'
      WHEN f16>=25 AND f16<50 THEN '2nd_q'
      ELSE '1st_q' END AS quarts
FROM c16
where y1 = 2016
and f16 is not null
and c1 != 'World'
group by 2
order by 1 desc

```

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

```
WITH c16 AS (SELECT region as r1,country_name AS c1,year as y1,percent_of_forest AS f16
FROM forestation
WHERE year = 2016
)
SELECT r1,c1, y1,f16,case
    WHEN f16>=75 THEN '4th_q'
    WHEN f16>=50 AND f16<75 THEN '3rd_q'
    WHEN f16>=25 AND f16<50 THEN '2nd_q'
    ELSE '1st_q' END AS quarts
FROM c16
where f16 >75 and
y1 = 2016
and f16 is not null
and c1 != 'World'
order by 4 desc
```

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

```
WITH c16 AS (SELECT country_name AS c1,year as y1,percent_of_forest AS f16
FROM forestation
WHERE year = 2016
)
SELECT count(c1),y1, case
    WHEN f16>=75 THEN '4th_q'
    WHEN f16>=50 AND f16<75 THEN '3rd_q'
    WHEN f16>=25 AND f16<50 THEN '2nd_q'
    ELSE '1st_q' END AS quarts
FROM c16
where f16 > (select f16
from c16
where c1 = 'United States')
and y1 = 2016
and f16 is not null
and c1 != 'World'
group by 2,3
```