

# 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  $41282694.90 \text{ km}^2$  in 1990. As of 2016, the most recent year for which data was available, that number had fallen to  $39958245.90 \text{ km}^2$ , a loss of  $1324449.00 \text{ km}^2$ , 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  $1279999.99 \text{ km}^2$ ).

## 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.

Figure 2.1: Country Details Forest Area Change Percentage, 1990 & 2016:

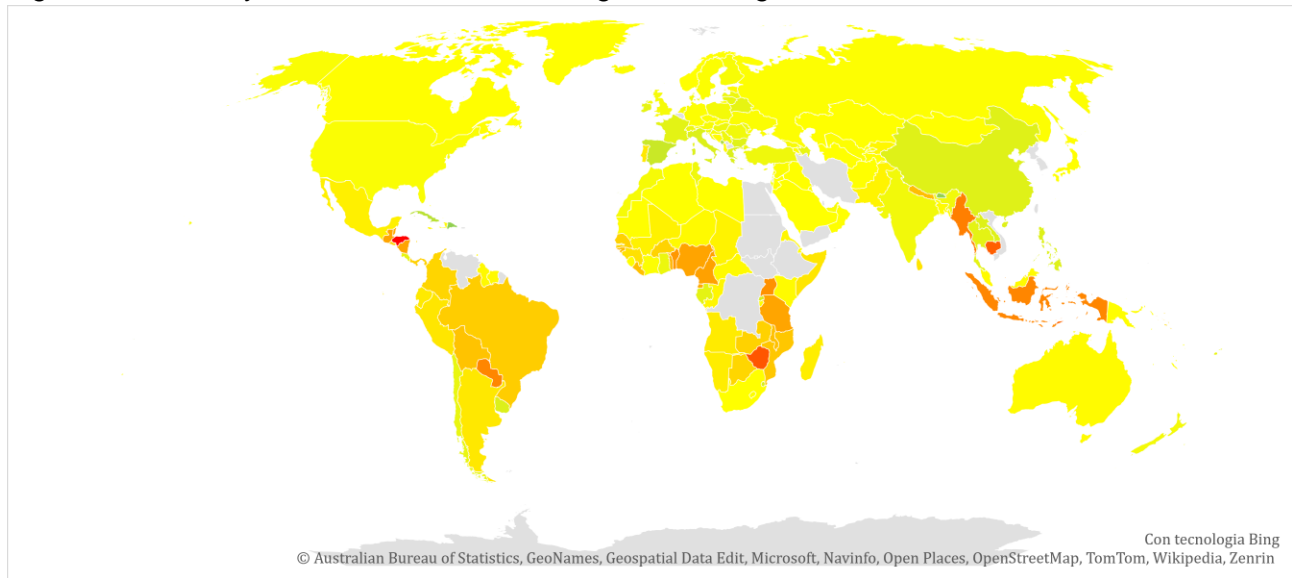


Table 2.1: Percent Forest Area by Region, 1990 & 2016:

Region	1990 Forest In %	2016 Forest In %	Forest Area Change In %
Latin America & Caribbean	51.03	46.16	-4.87
Europe & Central Asia	37.27	38.06	0.79
North America	35.65	36.04	0.39
World	32.42	31.38	-1.04
Sub-Saharan Africa	32.19	27.56	-4.63
East Asia & Pacific	25.77	26.36	0.59
South Asia	16.51	17.51	1.00
Middle East & North Africa	1.78	2.07	0.29

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 (32.19% to 27.56%). 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 **527229.06 km<sup>2</sup>**. 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 **79200.00 km<sup>2</sup>**, much lower than the figure for **China**.

**China** 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 **214%** from 1990 to 2016.

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

Region	Country	Total Area 2016 In km <sup>2</sup>	Forest Area Change In km <sup>2</sup>
East Asia & Pacific	China	9388210.01	527229.06
North America	United States	9147419.99	79200.00
South Asia	India	2973190.01	69213.98
Europe & Central Asia	Russian Federation	16376870.00	59395.00
East Asia & Pacific	Vietnam	310070.01	55390.00

Table 3.2: Top 5 Increase in Forest Area percentage by Country, 1990 & 2016:

Region	Country	Total Area 2016 In km <sup>2</sup>	Forest Area Change In %
Europe & Central Asia	Iceland	100249.99	214
East Asia & Pacific	French Polynesia	3660.01	182
Middle East & North Africa	Bahrain	778.01	177
Latin America & Caribbean	Uruguay	175020.00	134
Latin America & Caribbean	Dominican Republic	48310.00	82

## 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 3.3: Top 3 Amount Decrease in Forest Area by Country, 1990 & 2016:

Region	Country	Total Area 2016 In $km^2$	Absolute Forest Area Change
Latin America & Caribbean	Brazil	8358140.00	541510.00
East Asia & Pacific	Indonesia	1811570.01	282193.98
East Asia & Pacific	Myanmar	653080.00	107234.00

The second way to consider which countries are of concern is to analyze the data by percent decrease.

Table 3.4: Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016:

Region	Country	Total Area 2016 In $km^2$	Pct Forest Area Change
Sub-Saharan Africa	Togo	54390.00	75
Sub-Saharan Africa	Nigeria	910770.00	62
Sub-Saharan Africa	Uganda	200520.00	59
Sub-Saharan Africa	Mauritania	1030700.01	47
Latin America & Caribbean	Honduras	111889.99	45

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 3.5: Count of Countries Grouped by Forestation Percent Quartiles, 2016:

Quartile	Number of Countries
1	85
2	72
3	38
4	9

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 3.6: Top Quartile Countries, 2016:

Region	Country	Pct Designated as Forest
Latin America & Caribbean	Suriname	98.26
East Asia & Pacific	Micronesia, Fed. Sts.	91.86
Sub-Saharan Africa	Gabon	90.04
Sub-Saharan Africa	Seychelles	88.41
East Asia & Pacific	Palau	87.61
East Asia & Pacific	American Samoa	87.50
Latin America & Caribbean	Guyana	83.90
East Asia & Pacific	Lao PDR	82.11
East Asia & Pacific	Solomon Islands	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?*

*From the analysis conducted, it is evident that countries that have driven capitalism, such as the United States and China, have taken some remedial actions during the analyzed period by increasing their forestation percentages compared to 1990. It is also clear that the countries bearing the brunt of the current production system are those that are less economically developed and more affected by desertification. It would be intriguing to analyze a broader spectrum of data, spanning at least a century, to understand the impact of the current production system on resources such as forests. In the final analysis, the overall picture remains negative at a global level. The major powers have indeed intervened, but in my opinion, if we look back to data from the beginning of the century, the balance will likely not be positive.*

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

*In continuity with the previous answer, I believe that attention should be focused on former colonial countries in the Sub-Saharan Africa region. Nigeria is a striking example, being a territory rich in natural and mineral resources but economically poor and politically unstable. Despite the encouraging results regarding China and the United States, it is important to highlight that China plays a significant role in Nigeria, having recently promoted multiple economic initiatives and investments in that country. What does not emerge from the data, but is part of a broader context, is how certain countries tend to export their "dirt" beyond their own borders, to the detriment of developing nations. In conclusion, the global data on this issue (which is part of a much larger context) sends a clear message: the entire world is at a significant loss. It does not matter if this or that country shows a positive result over a decade by exploiting the resources of another country for production and profit; we are all on the same planet.*

## 5. APPENDIX: SQL Queries Used

```
CREATE OR REPLACE VIEW forestation AS
WITH t0 AS (
  SELECT
    r.country_name,
    r.country_code,
    r.region,
    r.income_group,
    la.year,
    la.total_area_sq_mi::numeric * 2.59 AS total_area_sq_km,
    fa.forest_area_sqkm AS forest_area_sq_km
  FROM
    regions r
```

```

        JOIN
            land_area la ON r.country_code = la.country_code
            AND COALESCE(la.total_area_sq_mi, 0)::double precision <> 0::double
precision
        JOIN
            forest_area fa ON la.country_code = fa.country_code
            AND la.year = fa.year
            AND fa.forest_area_sqkm IS NOT NULL
    )
SELECT
    country_name,
    country_code,
    region,
    income_group,
    year,
    total_area_sq_km,
    forest_area_sq_km,
    forest_area_sq_km / total_area_sq_km::double precision * 100::double
precision AS perc_land_designed_as_forest_sq_km
FROM
    t0;

```

```

-- 1. GLOBAL SITUATION
-- G_Q1 - According to the World Bank, what was the total forest area of the
world in 1990?
-- G_Q2 - As of 2016, the most recent year for which data was available, what had
that number fallen to?
-- G_Q3 - As of 2016, the most recent year for which data was available, what was
the loss in absolute terms?
-- G_Q4 - As of 2016, the most recent year for which data was available, what was
the loss in percentage terms?
-- G_Q5 - The forest area lost over this time period is slightly more than the
entire land area of which country listed for the year 2016?
-- G_Q6 - What was the entire land area of that country listed for the year 2016?

SELECT Round(f1.forest_area_sq_km :: numeric, 2) AS forest_area_sq_km_1990,
        Round(f2.forest_area_sq_km :: numeric, 2) AS forest_area_sq_km_2016,
        Round(Abs(f2.forest_area_sq_km - f1.forest_area_sq_km):: numeric, 2) AS
forest_area_sq_km_lost,
        Round((Abs(f2.forest_area_sq_km - f1.forest_area_sq_km)/
f1.forest_area_sq_km * 100):: numeric, 2) AS forest_area_pct_lost
FROM forestation f1
JOIN forestation f2 ON f1.country_code = f2.country_code

```

```

AND f1.country_name = f2.country_name
WHERE 1 = 1
    AND f1.country_name = 'World'
    AND f1."year" = 1990
    AND f2."year" = 2016;

SELECT country_name,
       Round(total_area_sq_km, 2) AS total_area_sq_km
FROM forestation f
WHERE 1 = 1
    AND "year" = 2016
    AND total_area_sq_km <=
        (SELECT Max(Round(Abs(f2.forest_area_sq_km - f1.forest_area_sq_km) ::
NUMERIC, 2))
        FROM forestation f1
        JOIN forestation f2 ON f1.country_code = f2.country_code
        AND f1.country_name = f2.country_name
        WHERE 1 = 1
            AND f1.country_name = 'World'
            AND f1."year" = 1990
            AND f2."year" = 2016)
ORDER BY total_area_sq_km DESC
LIMIT 1;

-- 2. REGIONAL OUTLOOK
-- 2_Q1 - Figure 2.1: Country Details Forest Area Change Percentage, 1990 & 2016:

SELECT f1.country_name,
       Round(100 - (SUM(f1.forest_area_sq_km) / SUM(f2.forest_area_sq_km) * 100)
:: NUMERIC, 2) AS forest_area_change_in_perc
FROM forestation f1
JOIN forestation f2 ON f1.country_code = f2.country_code
AND f1.country_name = f2.country_name
WHERE 1 = 1
    AND f1.country_name <> 'World'
    AND f1."year" = 1990
    AND f2."year" = 2016
GROUP BY f1.country_name
ORDER BY 2 DESC;

-- 2_Q2 - Table 2.1: Percent Forest Area by Region, 1990 & 2016

SELECT f1.region,

```



```

        Round((SUM(f1.forest_area_sq_km) / SUM(f1.total_area_sq_km) * 100) ::
NUMERIC, 2) AS forest_percentage_in_1990,
        Round((SUM(f2.forest_area_sq_km) / SUM(f2.total_area_sq_km) * 100) ::
NUMERIC, 2) AS forest_percentage_in_2016,
        Round((SUM(f2.forest_area_sq_km) / SUM(f2.total_area_sq_km) * 100) ::
NUMERIC, 2) - Round((SUM(f1.forest_area_sq_km) / SUM(f1.total_area_sq_km) * 100)
:: NUMERIC, 2) AS forest_area_change_in_perc
FROM forestation f1
JOIN forestation f2 ON f1.country_code = f2.country_code
AND f1.country_name = f2.country_name
WHERE 1 = 1
    AND f1."year" = 1990
    AND f2."year" = 2016
GROUP BY f1.region
ORDER BY 2 DESC;

```

-- 3. COUNTRY-LEVEL DETAIL

-- 3.A. SUCCESS STORIES

-- 3\_A\_Q1 - Table 3.1: Top 5 Increase in Forest Area by Country, 1990 & 2016

```

SELECT f1.region,
       f1.country_name,
       round(sum(f2.total_area_sq_km):: numeric, 2) AS total_area_sq_km_2016,
       Round(Abs(sum(f2.forest_area_sq_km) - sum(f1.forest_area_sq_km)) ::
NUMERIC, 2) AS forest_area_change_sqkm
FROM forestation f1
JOIN forestation f2 ON f1.country_code = f2.country_code
AND f1.country_name = f2.country_name
AND f2.forest_area_sq_km >= f1.forest_area_sq_km
WHERE 1 = 1
    AND f1.country_name <> 'World'
    AND f1."year" = 1990
    AND f2."year" = 2016
GROUP BY f1.country_name,
         f1.region
ORDER BY 4 DESC
LIMIT 5;

```

-- 3\_A\_Q2 - Table 3.2: Top 5 Increase in Forest Area percentage by Country, 1990 & 2016

```

SELECT f1.region,
       f1.country_name,
       round(sum(f2.total_area_sq_km):: numeric, 2) AS total_area_sq_km_2016,

```

```

        Round(Abs((1 - sum(f2.forest_area_sq_km)/ sum(f1.forest_area_sq_km))* 100)
:: NUMERIC, 0) AS forest_area_change_sqkm
FROM forestation f1
JOIN forestation f2 ON f1.country_code = f2.country_code
AND f1.country_name = f2.country_name
AND f2.forest_area_sq_km >= f1.forest_area_sq_km
WHERE 1 = 1
    AND f1.country_name <> 'World'
    AND f1."year" = 1990
    AND f2."year" = 2016
GROUP BY f1.region,
         f1.country_name
ORDER BY 4 DESC
LIMIT 5;

```

-- 3.B. LARGEST CONCERNS

-- 3\_B\_Q1 - Table 3.3: Top 3 Amount Decrease in Forest Area by Country, 1990 & 2016

```

SELECT f1.region,
       f1.country_name,
       round(sum(f2.total_area_sq_km):: numeric, 2) AS total_area_sq_km_2016,
       Round(Abs(sum(f2.forest_area_sq_km)- sum(f1.forest_area_sq_km)) ::
NUMERIC, 0) AS forest_area_change_sqkm
FROM forestation f1
JOIN forestation f2 ON f1.country_code = f2.country_code
AND f1.country_name = f2.country_name
AND f2.forest_area_sq_km <= f1.forest_area_sq_km
WHERE 1 = 1
    AND f1.country_name <> 'World'
    AND f1."year" = 1990
    AND f2."year" = 2016
GROUP BY f1.region,
         f1.country_name
ORDER BY 4 DESC
LIMIT 3;

```

-- 3\_B\_Q2 - Table 3.4: Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016

```

SELECT f1.region,
       f1.country_name,
       round(sum(f2.total_area_sq_km):: numeric, 2) AS total_area_sq_km_2016,
       Round(Abs((1 - sum(f2.forest_area_sq_km)/ sum(f1.forest_area_sq_km))* 100)
:: NUMERIC, 0) AS forest_area_change_sqkm

```

```

FROM forestation f1
JOIN forestation f2 ON f1.country_code = f2.country_code
AND f1.country_name = f2.country_name
AND f2.forest_area_sq_km <= f1.forest_area_sq_km
WHERE 1 = 1
    AND f1.country_name <> 'World'
    AND f1."year" = 1990
    AND f2."year" = 2016
GROUP BY f1.region,
         f1.country_name
ORDER BY 4 DESC
LIMIT 5;

```

-- 3.C. QUARTILES

-- 3\_C\_Q1 - Table 3.5: Count of Countries Grouped by Forestation Percent  
Quartiles, 2016

```

SELECT CASE
    WHEN ROUND(perc_land_designed_as_forest_sq_km :: numeric, 2) BETWEEN
75 AND 100 THEN 4
    WHEN ROUND(perc_land_designed_as_forest_sq_km :: numeric, 2) BETWEEN
50 AND 75 THEN 3
    WHEN ROUND(perc_land_designed_as_forest_sq_km :: numeric, 2) BETWEEN
25 AND 50 THEN 2
    WHEN ROUND(perc_land_designed_as_forest_sq_km :: numeric, 2) BETWEEN 0
AND 25 THEN 1
    END AS quartile,
    count(*)
FROM forestation f
WHERE f."year" = 2016
    AND f.country_name <> 'World'
    AND perc_land_designed_as_forest_sq_km IS NOT NULL
GROUP BY 1
ORDER BY 1;

```

-- 3\_C\_Q2 - Table 3.6: Top Quartile Countries, 2016

```

SELECT region,
       country_name,
       ROUND(sum(perc_land_designed_as_forest_sq_km):: numeric, 2) AS
pct_designated_as_forest
FROM forestation f
WHERE f."year" = 2016
    AND f.country_name <> 'World'
    AND perc_land_designed_as_forest_sq_km IS NOT NULL

```

```
    AND ROUND(perc_land_designed_as_forest_sq_km :: numeric, 2) BETWEEN 75 AND 100
GROUP BY 1,
        2
ORDER BY 3 DESC;
```