# 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 [sq km] in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39,958,246 [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 1279999.9891 [sq km]).

## 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 Zimbabwe, with 35.54%, and the region with the lowest relative forestation was Afghanistan, 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 24.81 %, and the region with the lowest relative forestation was Middle East & North Africa, with 0,48% forestation.

Awesome work all good here!

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

| Region | 1990 Forest Percentage | 2016 Forest Percentage |
|---|---|---|
| Middle East & North Africa | 0.48 | 0.58 |
| South Asia | 1.91 | 2.09 |
| East Asia & Pacific | 15.21 | 16.07 |
| North America | 15.76 | 16.45 |
| Sub-Saharan Africa | 15.78 | 14.65 |
| Europe & Central Asia | 24.69 | 26.12 |
| Latin America & Caribbean | 24.81 | 23.15 |

This table is not correct! Note: World should be included to the regions

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Sub-Saharan Africa (dropped from 15.78% to 14.65%) and Latin America & Caribbean (24.81% to 23.15%). 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 21.38%.

# 3. **COUNTRY-LEVEL DETAIL**

## A. SUCCESS STORIES

There is one particularly bright spot in the data at the country level, Brazil. This country actually increased in forest area from 1990 to 2016 by 541,510 [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 Indonesia, but it only saw an increase of 282,194 [sq km], much lower than the figure for Mayanmar,
Nigeria and Tanzania 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. Honduras increased in forest area by 72.71% from 1990 to 2016.

The stories here also not accurate because of the errors above

## 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 [sq km] |
| --- | --- | --- |
| Brazil | Latin America & Caribbean | 541,510 |
| Indonesia | East Asia & Pacific | 282,194 |
| Myanmar | East Asia & Pacific | 107,234 |
| Nigeria | Sub-Saharan Africa | 106,506 |
| Tanzania | Sub-Saharan Africa | 102,320 |

Awesome! All good here

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 |
| --- | --- | --- |
| French Polynesia | East Asia & Pacific | -27.32 |
| Puerto Rico | Latin America & Caribbean | -23.93 |
| Vietnam | East Asia & Pacific | -19.29 |
| Dominican Republic | Latin America & Caribbean | -18.86 |
| Bhutan | South Asia | -18.83 |

This table is not correct!

## C. QUARTILES

Table 3.3: Count of Countries Grouped by Forestation Percent Quartiles, 2016:

| Quartile | Number of Countries |
|---|---|
| 1 | 52 |
| 2 | 51 |
| 3 | 51 |
| 4 | 51 |

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

There were 52 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 |

# 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?*

Although there is no strong regional tendency we can see that developing countries are more likely to be subject of deforestation. Problem occurs in Latin America region but also, what is not surprise, in Sub-Saharan Africa. Given economic circumstances this process of devastating forests in "3rd world countries" will be gradually increasing. Solution here may be promotion of international trade with United States and help given to those countries in their way to development. Knowledge transfer in terms of sustainable growth would be also a help.

## APPENDIX: SQL queries used

### 1/ Project introduction

```sql
CREATE VIEW forestation AS
SELECT
  /*full selection from forest area*/
  fa.country_code AS fa_country_code,
  fa.country_name AS fa_country_name,
  fa.year AS fa_year,
  fa.forest_area_sqkm AS fa_forest_area_sqkm,

  /*full selection from land area*/
  la.country_code AS la_country_code,
  la.country_name As la_country_name,
  la.year AS la_year,
  la.total_area_sq_mi AS la_total_area_sq_mi,

  /*full selection from regions*/
  r.country_name AS r_country_name,
  r.country_code AS r_country_code,
  r.region AS r_region,
  r.income_group AS r_income_group,
/*additional column to see % of forestation, no rounding*/
(fa.forest_area_sqkm / (la.total_area_sq_mi*2.59))*100 AS forestation_percent

  FROM forest_area AS fa
    JOIN land_area as la
    ON fa.country_code = la.country_code
      AND fa.year = la.year

    JOIN regions AS r
    ON fa.country_code = r.country_code;
```

### 2/ Global situation

```sql
/*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 tabl
e.*/

answer: 41282694.9

SELECT *
FROM forestation
WHERE fa_country_name = 'World'
  AND fa_year = 1990;
```

```sql
/*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."*/

answer: 39958245.9

SELECT *
FROM forestation
WHERE fa_country_name = 'World'
  AND fa_year = 2016;

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

answer: 1324449

SELECT *
FROM forestation
WHERE fa_country_name = 'World'
  AND fa_year = 2016
  OR fa_country_name = 'World'
  AND fa_year = 1990;

/*d. What was the percent change in forest area of the world between 1990 and 201
6?*/
answer: 3.20824258980244%




/*e. If you compare the amount of forest area lost between 1990 and 2016, to whic
h country's total area in 2016 is it closest to?*/
answer: in 2016 forest area lost was closest to total area of Peru (1279999.9891)
 km2

SELECT *,
(la_total_area_sq_mi * 2.59) AS la_total_area_sq_km
FROM forestation
WHERE (la_total_area_sq_mi * 2.59)
  /*applying 1% threshold to see which country will fits the best and iterate by
  1%, on 4% variation we finally have result*/
    BETWEEN 1324449 *0.96 AND 1324449 *1.04
```

```
        AND fa_year = 2016;
```

3/Regional outlook

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

answer: 31.38

WITH stats AS (
  SELECT r_region,
    r_country_name,
    fa_year,
  (la_total_area_sq_mi * 2.59) AS la_total_area_sq_km,
    fa_forest_area_sqkm,
    (fa_forest_area_sqkm / (la_total_area_sq_mi * 2.59)) * 100 AS forestation_per
centage
    FROM forestation
)
SELECT r_country_name,
ROUND(CAST(forestation_percentage AS NUMERIC) , 2)
FROM stats
WHERE fa_year = 2016 AND r_country_name = 'World';

/*Which region had the HIGHEST percent forest in 2016,*/

answer: Zimbabwe

WITH stats AS (
  SELECT r_region,
    r_country_name,
    fa_year,
  (la_total_area_sq_mi * 2.59) AS la_total_area_sq_km,
    fa_forest_area_sqkm,
    (fa_forest_area_sqkm / (la_total_area_sq_mi * 2.59)) * 100 AS forestation_per
centage
    FROM forestation
)
SELECT r_country_name,
       ROUND(CAST(forestation_percentage AS NUMERIC) , 2)
FROM stats
WHERE fa_year = 2016
ORDER BY r_country_name DESC
LIMIT 1;

/*and which had the LOWEST, to 2 decimal places?*/
```

answer: Afghanistan

```sql
WITH stats AS (
  SELECT r_region,
    r_country_name,
    fa_year,
  (la_total_area_sq_mi * 2.59) AS la_total_area_sq_km,
    fa_forest_area_sqkm,
    (fa_forest_area_sqkm / (la_total_area_sq_mi * 2.59)) * 100 AS forestation_per
centage
    FROM forestation
)
SELECT r_country_name,
       ROUND(CAST(forestation_percentage AS NUMERIC) , 2)
FROM stats
WHERE fa_year = 2016
ORDER BY r_country_name
LIMIT 1;


/*b. What was the percent forest of the entire world in 1990? Which region had th
e HIGHEST percent forest in 1990, and which had the LOWEST, to 2 decimal places?*
/
```

answer: 32.42

```sql
WITH stats AS (
  SELECT r_region,
    r_country_name,
    fa_year,
    (la_total_area_sq_mi * 2.59) AS la_total_area_sq_km,
    fa_forest_area_sqkm,
    (fa_forest_area_sqkm / (la_total_area_sq_mi * 2.59)) * 100 AS forestation_per
centage
  FROM forestation
)
SELECT r_country_name,
ROUND(CAST(forestation_percentage AS NUMERIC) , 2)
FROM stats
WHERE fa_year = 1990 AND r_country_name = 'World';


/*HIGHEST*/
```
answer: Zimbabwe

```sql
WITH stats AS (
  SELECT r_region,
    r_country_name,
    fa_year,
   (la_total_area_sq_mi * 2.59) AS la_total_area_sq_km,
    fa_forest_area_sqkm,
    (fa_forest_area_sqkm / (la_total_area_sq_mi * 2.59)) * 100 AS forestation_per
centage
    FROM forestation
)
SELECT r_country_name,
      ROUND(CAST(forestation_percentage AS NUMERIC) , 2)
FROM stats
WHERE fa_year = 1990
ORDER BY r_country_name DESC
LIMIT 1;

/*LOWEST*/
answer: Afghanistan

WITH stats AS (
  SELECT r_region,
    r_country_name,
    fa_year,
   (la_total_area_sq_mi * 2.59) AS la_total_area_sq_km,
    fa_forest_area_sqkm,
    (fa_forest_area_sqkm / (la_total_area_sq_mi * 2.59)) * 100 AS forestation_per
centage
    FROM forestation
).
SELECT r_country_name,
      ROUND(CAST(forestation_percentage AS NUMERIC) , 2)
FROM stats
WHERE fa_year = 1990
ORDER BY r_country_name
LIMIT 1;



/*for 2016 all regions*/
SELECT r_region,
  SUM(fa_forest_area_sqkm) AS sum_2016,
  SUM(fa_forest_area_sqkm) / (SELECT fa_forest_area_sqkm FROM forestation WHERE r
_region ='World' AND fa_year = 2016) AS region_forestation_percent
```

```sql
  FROM forestation
  WHERE fa_year = 2016
    AND r_region != 'World'
    AND forestation_percent != 0
  GROUP BY r_region
  ORDER BY region_forestation_percent;

  /*for all 1990 regions*/
  SELECT r_region,
  SUM(fa_forest_area_sqkm) AS sum_1990,
  SUM(fa_forest_area_sqkm) / (SELECT fa_forest_area_sqkm FROM forestation WHERE r
_region ='World' AND fa_year = 1990) AS region_forestation_percent
  FROM forestation
  WHERE fa_year = 1990
    AND r_region != 'World'
    AND forestation_percent != 0
  GROUP BY r_region
  ORDER BY region_forestation_percent;

/*the percent forest area of the world decreased over this time period from % to
%. */

SELECT forestation_percent, r_region
FROM forestation
WHERE fa_year = 1990 AND r_region = 'World'
```

4/Country Level detail

```sql
*
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
forest1990.fa_country_name,
forest1990.fa_forest_area_sqkm AS forest_area_1990,
forest2016.fa_forest_area_sqkm AS forest_area_2016,
forest1990.fa_forest_area_sqkm -
 forest2016.fa_forest_area_sqkm AS forest_area_delta,
forest1990.forestation_percent AS forestation_percent_1990,
forest2016.forestation_percent AS forestation_percent_2016,
ROUND(CAST(forest1990.forestation_percent AS NUMERIC) -
 CAST(forest2016.forestation_percent AS NUMERIC) , 2) AS forestation_percent_delt
a
FROM
```

```sql
    (SELECT fa_country_name,
        fa_forest_area_sqkm,
        forestation_percent
    FROM forestation
    WHERE fa_year = 1990)  forest1990

JOIN

    (SELECT fa_country_name,
        fa_forest_area_sqkm,
        forestation_percent
    FROM forestation
    WHERE fa_year = 2016)  forest2016

ON forest1990.fa_country_name = forest2016.fa_country_name
WHERE (forest1990.fa_forest_area_sqkm -
 forest2016.fa_forest_area_sqkm ) IS NOT NULL
    AND forest1990.fa_country_name != 'World'
ORDER BY forest_area_delta DESC
LIMIT 5
```

answer:

| fa_country_name | forest_area_1990 | forest_area_2016 | forest_area_delta | forestation_percent_1990 | forestation_percent_2016 | forestation_percent_delta |
|---|---|---|---|---|---|---|
| Brazil | 5467050 | 4925540 | 541510 | 65.4098878677729 | 58.9310540580807 | 6.48 |
| Indonesia | 1185450 | 903256.0156 | 282193.9844 | 65.437713915539 | 49.8603979428255 | 15.58 |
| Myanmar | 392180 | 284945.9961 | 107234.0039 | 60.008567845761 | 43.6311012853746 | 16.38 |
| Nigeria | 172340 | 65833.99902 | 106506.00098 | 18.9224501616999 | 7.2283890298326 | 11.69 |
| Tanzania | 559200 | 456880 | 102320 | 63.1293749472485 | 51.5782346672012 | 11.55 |

```sql
/*
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
forest1990.fa_country_name,
forest1990.r_region,
forest1990.fa_forest_area_sqkm AS forest_area_1990,
forest2016.fa_forest_area_sqkm AS forest_area_2016,
forest2016.fa_forest_area_sqkm -
 forest1990.fa_forest_area_sqkm AS forest_area_delta,
forest1990.forestation_percent AS forestation_percent_1990,
```

```sql
  forest2016.forestation_percent AS forestation_percent_2016,
  ROUND(CAST(forest1990.forestation_percent AS NUMERIC) -
   CAST(forest2016.forestation_percent AS NUMERIC) , 2) AS forestation_percent_delta
FROM
    (SELECT fa_country_name,
        r_region,
        fa_forest_area_sqkm,
        forestation_percent
    FROM forestation
    WHERE fa_year = 1990)  forest1990

JOIN

    (SELECT fa_country_name,
        fa_forest_area_sqkm,
        forestation_percent
    FROM forestation
    WHERE fa_year = 2016)  forest2016

ON forest1990.fa_country_name = forest2016.fa_country_name
WHERE ROUND(CAST(forest1990.forestation_percent AS NUMERIC) -
 CAST(forest2016.forestation_percent AS NUMERIC) , 2) != 0
ORDER BY forest_area_delta
```

answer:

| fa_country_name | forest_area_1990 | forest_area_2016 | forest_area_delta | forestation_percent_1990 | forestation_percent_2016 | forestation_percent_delta |
|---|---|---|---|---|---|---|
| Honduras | 81360 | 44720 | 36640 | 72.7142766509195 | 39.9678275790206 | 32.75 |
| Korea, Dem. People's Rep. | 82010 | 49040 | 32970 | 68.1089573730735 | 40.7275121274908 | 27.38 |
| Zimbabwe | 221640 | 137495.9961 | 84144.0039 | 57.2935262955069 | 35.54245834724 | 21.75 |
| Cambodia | 129440 | 93295.99609 | 36144.00391 | 73.3288014351434 | 52.8529324163901 | 20.48 |
| Timor-Leste | 9660 | 6747.999878 | 2912.000122 | 64.9630437954009 | 45.3799804975025 | 19.58 |

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

WITH quartile_data AS (
```

```sql
SELECT NTILE(4) OVER (ORDER BY forestation_percent) AS quartile,
fa_country_name,
fa_year,
forestation_percent
FROM forestation
WHERE fa_year = 2016
    AND forestation_percent <> 0)

SELECT quartile, COUNT (quartile) AS quartile_counter
FROM quartile_data
GROUP BY quartile
ORDER BY quartile_counter DESC;

answer: quartile 1 (52 vs 51 in 2nd, 3rd and 4th)

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

WITH quartile_data AS (
SELECT NTILE(4) OVER (ORDER BY forestation_percent) AS quartile,
fa_country_name,
fa_year,
r_region,
forestation_percent
FROM forestation
WHERE fa_year = 2016
    AND forestation_percent <> 0)

SELECT *
FROM quartile_data
WHERE quartile = 4
    AND forestation_percent > 75
ORDER BY forestation_percent DESC;

answer:
quartile    fa_country_name fa_year forestation_percent
4    Suriname    2016    98.2576939676578
4    Micronesia, Fed. Sts.    2016    91.8572390715248
4    Gabon    2016    90.0376418700565
4    Seychelles    2016    88.4111367385789
4    Palau    2016    87.6068085491204
4    American Samoa    2016    87.5000875000875
4    Guyana    2016    83.9014489110682
```

```
4    Lao PDR 2016     82.1082317640861
4    Solomon Islands 2016     77.8635177945066

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

WITH calc_table AS(
SELECT
forestation_percent,
fa_country_name,
fa_year,
CASE
    WHEN forestation_percent > (SELECT forestation_percent FROM forestation WHERE
 fa_country_name = 'United States' AND fa_year = 2016)
    THEN 'TRUE'
    ELSE 'FALSE'
    END AS forest_vs_us_2016
FROM forestation
WHERE fa_year = 2016)
SELECT forest_vs_us_2016, COUNT(forest_vs_us_2016)
FROM calc_table
GROUP BY forest_vs_us_2016;

answer:
forest_vs_us_2016    count
TRUE     94
FALSE    124
```