

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.

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

| Region | 1990 Forest Percentage | 2016 Forest Percentage |
|----------------------------|------------------------|------------------------|
| East Asia & Pacific | 25.78 | 26.36 |
| Europe & Central Asia | 37.28 | 38.04 |
| Latin America & Caribbean | 51.03 | 46.16 |
| Middle East & North Africa | 1.78 | 2.07 |
| North America | 35.65 | 36.04 |
| South Asia | 16.51 | 17.51 |
| Sub-Saharan Africa | 30.67 | 28.79 |
| World | 32.42 | 31.38 |

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Sub-Saharan Africa (dropped from 30.67% to 28.79%) and Latin America & Caribbean (51.03% to 46.16%). 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 Myanmar, 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.

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 |

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 | -307.25 |
| Nigeria | Sub-Saharan Africa | -161.78 |
| Uganda | Sub-Saharan Africa | -144.67 |
| Mauritania | Sub-Saharan Africa | -87.78 |
| Honduras | Latin America & Caribbean | -81.93 |

When we consider countries that decreased in forest area 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 |
|----------|---------------------|
| 1 | 86 |
| 2 | 74 |
| 3 | 36 |
| 4 | 9 |

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

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 extremely strong regional tendency we can see that developing countries in Sub-Saharan Africa are more likely to be subject of complete deforestation. Given geographical landscape and poverty it's quite likely there are not enough funds for forestation maintenance. Focus should be put on Togo, Nigeria, Uganda and Mauritania. In more favorable position is Honduras that despite deforestation have all natural resources to prevent ecological catastrophe.

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 stronger countries 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

```
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

```
/*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;
```

/*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 2016?*/

answer: 3.20824258980244%

/*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?*/

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? 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?

answer:

| r_region | pct_round_2016 | pct_round_1990 |
|----------------------------|----------------|----------------|
| East Asia & Pacific | 26.36 | 25.78 |
| Europe & Central Asia | 38.04 | 37.28 |
| Latin America & Caribbean | 46.16 | 51.03 |
| Middle East & North Africa | 2.07 | 1.78 |
| North America | 36.04 | 35.65 |
| South Asia | 17.51 | 16.51 |
| Sub-Saharan Africa | 28.79 | 30.67 |
| World | 31.38 | 32.42 |

*/

```
WITH total_area_per_region_2016 AS (  
  SELECT DISTINCT r_region,  
    fa_year,  
    SUM(la_total_area_sq_mi * 2.59) OVER win_regions AS sum_total_area_km,  
    SUM(fa_forest_area_sqkm) OVER win_regions AS sum_total_forest_km,  
    (SUM(fa_forest_area_sqkm) OVER win_regions / SUM(la_total_area_sq_mi * 2.59) O  
ER win_regions)*100 AS pct_forest_2016  
  FROM forestation  
  WHERE fa_year = 2016  
  
  WINDOW win_regions AS (PARTITION BY r_region ORDER BY r_region)  
)  
total_area_per_region_1990 AS (  
  SELECT DISTINCT r_region,  
    fa_year,  
    SUM(la_total_area_sq_mi * 2.59) OVER win_regions AS sum_total_area_km,  
    SUM(fa_forest_area_sqkm) OVER win_regions AS sum_total_forest_km,  
    (SUM(fa_forest_area_sqkm) OVER win_regions / SUM(la_total_area_sq_mi * 2.59) O  
ER win_regions)*100 AS pct_forest_1990  
  FROM forestation  
  WHERE fa_year = 1990
```



```

    WINDOW win_regions AS (PARTITION BY r_region ORDER BY r_region)
)
SELECT
total_area_per_region_2016.r_region,
ROUND(CAST(pct_forest_2016 AS NUMERIC), 2) AS pct_round_2016,
ROUND(CAST(pct_forest_1990 AS NUMERIC), 2) AS pct_round_1990
FROM total_area_per_region_2016
JOIN total_area_per_region_1990
ON total_area_per_region_2016.r_region = total_area_per_region_1990.r_region
ORDER BY total_area_per_region_2016.r_region;

```

4/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?

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?
*/

WITH total_area_per_region_2016 AS (
    SELECT fa_country_name,
           r_region,
           fa_year,
           ROUND(fa_forest_area_sqkm) AS forest_area_sqkm_2016
    FROM forestation
    WHERE fa_year = 2016 AND fa_forest_area_sqkm != 0
    ORDER BY forest_area_sqkm_2016 DESC
),
total_area_per_region_1990 AS (
    SELECT fa_country_name,
           r_region,
           fa_year,
           ROUND(fa_forest_area_sqkm) AS forest_area_sqkm_1990
    FROM forestation
    WHERE fa_year = 1990 AND fa_forest_area_sqkm != 0
    ORDER BY forest_area_sqkm_1990 DESC
)
SELECT
total_area_per_region_2016.fa_country_name,
total_area_per_region_2016.r_region,

```

```

forest_area_sqkm_2016,
forest_area_sqkm_1990,
(forest_area_sqkm_1990 - forest_area_sqkm_2016) AS forest_area_delta,
ROUND(CAST(((forest_area_sqkm_2016 -
  forest_area_sqkm_1990)/forest_area_sqkm_2016)*100 AS NUMERIC), 2) AS forest_pct_
delta

FROM total_area_per_region_2016
JOIN total_area_per_region_1990
ON total_area_per_region_2016.fa_country_name = total_area_per_region_1990.fa_cou
ntry_name
ORDER BY /*forest_area_delta DESC*/ forest_pct_delta ;
/* a
fa_country_name r_region                forest_area_delta
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
*/

/* b
fa_country_name      r_region                forest_pct_delta
Togo                 Sub-Saharan Africa     -307.25
Nigeria             Sub-Saharan Africa     -161.78
Uganda              Sub-Saharan Africa     -144.67
Mauritania          Sub-Saharan Africa     -87.78
Honduras            Latin America & Caribbean -81.93
*/

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

WITH forest_2016 AS(
SELECT fa_country_name AS country,
r_region AS region,
ROUND(CAST(fa_forest_area_sqkm / (la_total_area_sq_mi * 2.59) AS NUMERIC) * 100,
2) AS pct_forest_2016
FROM forestation
WHERE fa_year = 2016
      AND fa_forest_area_sqkm != 0
      AND la_total_area_sq_mi != 0
ORDER BY pct_forest_2016 DESC
)
SELECT

```

```

CASE WHEN pct_forest_2016 <= 25 THEN 'Q1'
      WHEN pct_forest_2016 > 25 AND pct_forest_2016 <=50 THEN 'Q2'
      WHEN pct_forest_2016 > 50 AND pct_forest_2016 <=75 THEN 'Q3'
      ELSE 'Q4'
END AS quartile,
COUNT(country)
FROM forest_2016
GROUP BY quartile
ORDER BY quartile;

/*
quartile    count
Q1           86
Q2           74
Q3           36
Q4            9
*/

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

WITH forest_2016 AS(
SELECT fa_country_name AS country,
r_region AS region,
ROUND(CAST(fa_forest_area_sqkm / (la_total_area_sq_mi * 2.59) AS NUMERIC) * 100,
2) AS pct_forest_2016
FROM forestation
WHERE fa_year = 2016
      AND fa_forest_area_sqkm != 0
      AND la_total_area_sq_mi != 0
ORDER BY pct_forest_2016 DESC
)
SELECT
CASE WHEN pct_forest_2016 <= 25 THEN 'Q1'
      WHEN pct_forest_2016 > 25 AND pct_forest_2016 <=50 THEN 'Q2'
      WHEN pct_forest_2016 > 50 AND pct_forest_2016 <=75 THEN 'Q3'
      ELSE 'Q4'
END AS quartile,
country,
region,
pct_forest_2016
FROM forest_2016
ORDER BY quartile DESC;

```

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

```
/*answer: 94*/
```

```
WITH forest_2016 AS(  
  SELECT fa_country_name AS country,  
         r_region AS region,  
         ROUND(CAST(fa_forest_area_sqkm / (la_total_area_sq_mi * 2.59) AS NUMERIC) * 100,  
               2) AS pct_forest_2016  
  FROM forestation  
 WHERE fa_year = 2016  
       AND fa_forest_area_sqkm != 0  
       AND la_total_area_sq_mi != 0  
 ORDER BY pct_forest_2016 DESC  
)  
SELECT  
COUNT(*)  
FROM forest_2016  
WHERE pct_forest_2016 > (SELECT pct_forest_2016 FROM forest_2016 WHERE country =  
                          'United States');
```