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 to39,958,246 [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 Latin America & Caribbean, with 46.16%, and the region with the lowest relative forestation was Middle East & North Africa, with 2,07%.

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 |
| 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 31.38%.

## 3. **COUNTRY-LEVEL DETAIL**

### 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 [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 79,200 [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 213.66% from 1990 to 2016.

### 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 | -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 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.

### QUARTILES

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

|  |  |
| --- | --- |
| Quartile | Number of Countries |
| 1 | 85 |
| 2 | 73 |
| 3 | 38 |
| 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 extremaly 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 likley 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 table.\*/

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

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) OVER 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) OVER 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 IS NOT NULL

  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 IS NOT NULL

  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\_2016 - forest\_area\_sqkm\_1990) AS forest\_area\_delta,

ROUND(CAST(((forest\_area\_sqkm\_2016 - forest\_area\_sqkm\_1990)/forest\_area\_sqkm\_1990)\*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\_country\_name

ORDER BY forest\_area\_delta DESC /\*forest\_pct\_delta\*/ ;

/\*

country forestation increase 3A

fa\_country\_name     forest\_area\_sqkm\_2016 forest\_area\_sqkm\_1990 forest\_area\_delta

China               2098635               1571406               527229

United States       3103700               3024500               79200

India               708604                639390                69214

Russian Federation  8148895               8089500               59395

Vietnam             149020                93630                 55390

\*/

/\* 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          -75.45

Nigeria     Sub-Saharan Africa          -61.8

Uganda      Sub-Saharan Africa          -59.13

Mauritania  Sub-Saharan Africa          -46.75

Honduras    Latin America & Caribbean   -45.03

\*/

/\*c. If countries were grouped by percent forestation in quartiles, which group had 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          85

Q2          73

Q3          38

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');