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 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 |
| 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 |

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**

### 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.

### 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 |
| 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 |

### 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

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

/\*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\_percentage

    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\_percentage

    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

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\_percentage

    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 the HIGHEST percent forest in 1990, and which had the LOWEST, to 2 decimal places?\*/

answer: 32.42

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\_percentage

  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

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\_percentage

    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\_percentage

    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

  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

\*

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\_delta

FROM

    (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

/\*

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,

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

/\*

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

\*/

WITH quartile\_data AS (

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