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 41282694.9 sq km in 1990. As of 2016, the most recent year for which data was available, that number had fallen to39958245.9 sq km, a loss of 1324449 sq km, or -3.2%.

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 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 "Europe & Central Asia" with 46.66 %, and the region with the lowest relative forestation was Middle East & North Africa, with 2.08 %

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 49.71 %, and the region with the lowest relative forestation was Middle East & North Africa, with 1.79 % forestation.

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

|  |  |  |
| --- | --- | --- |
| **region** | **forest\_percentage\_1990** | **forest\_percentage\_2016** |
| **Middle East & North Africa** | 1.79 | 2.08 |
| **South Asia** | 18.11 | 18.94 |
| **East Asia & Pacific** | 21.64 | 24.93 |
| **Sub-Saharan Africa** | 30.24 | 28.24 |
| **World** | 32.42 | 31.38 |
| **North America** | 34.34 | 34.96 |
| **Europe & Central Asia** | 45.9 | 46.66 |
| **Latin America & Caribbean** | 49.71 | 45.45 |

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Latin America & Caribbean (dropped from 49.71% to 45.45%) and Sub-Saharan Africa (30.24% to 28.24%). 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 527229 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 79200 sq km, much lower than the figure for 527229 sq km.

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. French Polynesia increased in forest area by 0.27% 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 | -541510 |
| Indonesia | East Asia & Pacific | -282193.98 |
| Myanmar | East Asia & Pacific | -107234.00 |
| Nigeria | Sub-Saharan Africa | -106506.00 |
| Tanzania | Sub-Saharan Africa | -102320 |

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 first 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 |

## 5. RECOMMENDATIONS

*Write out a set of recommendations as an analyst on the ForestQuery team.*

* *What have you learned from the World Bank data?*

*As we analyze the forestation data of World from 1990 to 2016, we observed that deforestation has happened during the course which has resulted in decrease in percentage forest area from 32% in 1990 to 31% in 2016. In absolute terms the forest area has declined by 1324450 sq km. If we compare the amount of forest area lost between 1990 and 2016(1324450 sq km), it is closest to the total land area of Peru (1279999.9 sq km) in 2016.*

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

After further diving into the data and fetching top 50 countries where major deforestation has happened from 1990 – 2016, **34** out of top 50 countries belong low income and lower middle-income group. Countries in Sub-Saharan Africa and Latin America & Caribbean regions are mostly of concern as **40** out of top 50 countries in terms of larger deforestation belongs to them.

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.

**APPENDIX: SQL queries used**

Create a **View** called **“forestation”** by joining all three tables - **forest\_area, land\_area** and **regions** in the workspace.

CREATE VIEW forestation AS (

SELECT DISTINCT

COALESCE(fa.country\_code,la.country\_code) as country\_code,

COALESCE(fa.year, la.year) as year,

COALESCE(fa.country\_name,la.country\_name) as country\_name,

fa.forest\_area\_sqkm as forest\_area\_sqkm,

(la.total\_area\_sq\_mi) \* 2.59 as total\_area\_sqkm,

(fa.forest\_area\_sqkm / ((la.total\_area\_sq\_mi) \* 2.59))\*100 as perc\_land\_forest,

reg.region ,

reg.income\_group

FROM forest\_area fa

INNER JOIN land\_area la

ON fa.country\_code = la.country\_code

AND fa."year" = la."year"

INNER JOIN regions reg

ON reg.country\_code = fa.country\_code

);

## 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.

SELECT forest\_area\_sqkm

FROM forestation

WHERE year = 1990

AND country\_name = 'World';

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.”

SELECT forest\_area\_sqkm

FROM forestation

WHERE year = 2016

AND country\_name = 'World';

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

WITH YR1990 AS (SELECT forest\_area\_sqkm, country\_name

FROM forestation

WHERE year = 1990

AND country\_name = 'World'),

YR2016 AS (SELECT forest\_area\_sqkm , country\_name

FROM forestation

WHERE year = 2016

AND country\_name = 'World')

SELECT (YR2016.forest\_area\_sqkm - YR1990.forest\_area\_sqkm) change\_forest\_area

FROM YR2016

INNER JOIN YR1990

ON YR2016.country\_name = YR1990.country\_name;

d. What was the percent change in forest area of the world between 1990 and 2016?

WITH YR1990 AS (SELECT forest\_area\_sqkm, country\_name

FROM forestation

WHERE year = 1990

AND country\_name = 'World'),

YR2016 AS (SELECT forest\_area\_sqkm , country\_name

FROM forestation

WHERE year = 2016

AND country\_name = 'World')

SELECT ROUND(((YR2016.forest\_area\_sqkm - YR1990.forest\_area\_sqkm)/YR1990.forest\_area\_sqkm)::numeric,2)\*100 AS Change

FROM YR2016

INNER JOIN YR1990

ON YR2016.country\_name = YR1990.country\_name;

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?

SELECT \*

FROM forestation

WHERE total\_area\_sqkm <=

(WITH YR1990 AS (SELECT forest\_area\_sqkm, country\_name

FROM forestation

WHERE year = 1990

AND country\_name = 'World'),

YR2016 AS (SELECT forest\_area\_sqkm , country\_name

FROM forestation

WHERE year = 2016

AND country\_name = 'World')

SELECT (YR1990.forest\_area\_sqkm -YR2016.forest\_area\_sqkm ) change\_forest\_area

FROM YR2016

INNER JOIN YR1990

ON YR2016.country\_name = YR1990.country\_name)

AND year = 2016

ORDER BY total\_area\_sqkm DESC

LIMIT 1;

## REGIONAL OUTLOOK

CREATE VIEW REGIONAL\_OUTLOOK AS(

SELECT region,year,

ROUND(((SUM(forest\_area\_sqkm)/SUM(total\_area\_sqkm))\*100)::numeric,2) AS perc\_forest

FROM (

WITH region\_distinct AS(

SELECT DISTINCT region, country\_code FROM regions ),

fa AS(SELECT DISTINCT country\_code,forest\_area\_sqkm ,year

FROM forest\_area),

la AS(SELECT DISTINCT country\_code,(total\_area\_sq\_mi\*2.59) total\_area\_sqkm ,year

FROM land\_area)

SELECT DISTINCT r.region,r.country\_code,forest\_area\_sqkm,total\_area\_sqkm, fa.year

FROM region\_distinct r

INNER JOIN fa

ON r.country\_code = fa.country\_code

INNER JOIN la

ON r.country\_code = la.country\_code

)a

WHERE year in (1990,2016)

GROUP BY 1,2

ORDER BY 3,1,2

);

Percent Forest Area by Region, 1990 & 2016

SELECT A.region,A.perc\_forest AS Forest\_Percentage\_1990,

B.perc\_forest AS Forest\_Percentage\_2016

FROM

(SELECT \*

FROM REGIONAL\_OUTLOOK

WHERE year = 1990) A

LEFT JOIN

(SELECT \*

FROM REGIONAL\_OUTLOOK

WHERE year = 2016)B

ON A.region = B.region;

* 1. 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?

SELECT \*

FROM REGIONAL\_OUTLOOK

WHERE region = 'World'

AND year = 2016;

HIGHEST percent forest in 2016:

SELECT region

FROM REGIONAL\_OUTLOOK

WHERE

year = 2016

ORDER BY perc\_forest DESC

LIMIT 1;

LOWEST percent forest in 2016:

SELECT region

FROM REGIONAL\_OUTLOOK

WHERE

year = 2016

ORDER BY perc\_forest ASC

LIMIT 1;;

1. 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?

SELECT \*

FROM REGIONAL\_OUTLOOK

WHERE region = 'World'

AND year = 1990;

HIGHEST percent forest in 1990:

SELECT \*

FROM REGIONAL\_OUTLOOK

WHERE

year = 1990

ORDER BY perc\_forest DESC

LIMIT 1;

LOWEST percent forest in 1990:

SELECT \*

FROM REGIONAL\_OUTLOOK

WHERE

year = 1990

ORDER BY perc\_forest ASC

LIMIT 1;

c. Based on the table you created, which regions of the world DECREASED in forest area from 1990 to 2016?

WITH t90 AS(SELECT \*

FROM REGIONAL\_OUTLOOK

WHERE year = 1990),

t16 AS(SELECT \*

FROM REGIONAL\_OUTLOOK

WHERE year = 2016)

SELECT t90.region,

t90.perc\_forest perc\_forest\_1990,

t16.perc\_forest perc\_forest\_2016,

(t90.perc\_forest - t16.perc\_forest) perc\_forest\_diff

FROM t90

INNER JOIN t16

ON t90.region = t16.region

WHERE (t90.perc\_forest - t16.perc\_forest) >0;

## 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?

WITH area\_1990 AS (

SELECT country\_name, forest\_area\_sqkm

FROM forestation

WHERE

year = 1990),

area\_2016 AS (

SELECT country\_name, forest\_area\_sqkm

FROM forestation

WHERE

year = 2016

)

SELECT t1.country\_name,t1.forest\_area\_sqkm as area90,t2.forest\_area\_sqkm as area16,

(t2.forest\_area\_sqkm-t1.forest\_area\_sqkm) as area\_diff

FROM area\_1990 t1

INNER JOIN area\_2016 t2

ON t1.country\_name = t2.country\_name

WHERE t1.forest\_area\_sqkm IS NOT NULL AND t2.forest\_area\_sqkm IS NOT NULL

AND t1.country\_name <> 'World'

ORDER BY t2.forest\_area\_sqkm-t1.forest\_area\_sqkm ASC

LIMIT 5;

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 area\_1990 AS (

SELECT country\_name,region, forest\_area\_sqkm

FROM forestation

WHERE

year = 1990),

area\_2016 AS (

SELECT country\_name,region, forest\_area\_sqkm

FROM forestation

WHERE

year = 2016)

SELECT t1.country\_name,t1.region,t1.forest\_area\_sqkm as area90 ,t2.forest\_area\_sqkm as area16,

ROUND((((t2.forest\_area\_sqkm-t1.forest\_area\_sqkm)/t1.forest\_area\_sqkm )\*100)::Numeric,2) as perc\_area\_diff

FROM area\_1990 t1

INNER JOIN area\_2016 t2

ON t1.country\_name = t2.country\_name

WHERE t1.forest\_area\_sqkm IS NOT NULL AND t2.forest\_area\_sqkm IS NOT NULL

AND t1.country\_name <> 'World'

ORDER BY ROUND(((t2.forest\_area\_sqkm-t1.forest\_area\_sqkm)/t1.forest\_area\_sqkm )::Numeric,2) ASC

LIMIT 5;

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

SELECT quartiles, count(\*)

FROM

(SELECT country\_name,ROUND(perc\_land\_forest::numeric,2) AS perc\_land\_forest,

CASE WHEN ROUND(perc\_land\_forest::numeric,2) >= 75 THEN '4'

WHEN ROUND(perc\_land\_forest::numeric,2) >= 50 THEN '3'

WHEN ROUND(perc\_land\_forest::numeric,2) >= 25 THEN '2'

ELSE '1' END quartiles

FROM forestation

WHERE year = 2016

AND perc\_land\_forest IS NOT NULL

)a

GROUP BY quartiles

ORDER BY quartiles;

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

SELECT quartiles, country\_name,region, perc\_land\_forest

FROM

(SELECT country\_name,region,ROUND(perc\_land\_forest::numeric,2) AS perc\_land\_forest,

CASE WHEN ROUND(perc\_land\_forest::numeric,2) >= 75 THEN '4'

WHEN ROUND(perc\_land\_forest::numeric,2) >= 50 THEN '3'

WHEN ROUND(perc\_land\_forest::numeric,2) >= 25 THEN '2'

ELSE '1' END quartiles

FROM forestation

WHERE year = 2016

AND perc\_land\_forest IS NOT NULL) t1

WHERE quartiles = '4'

ORDER BY perc\_land\_forest DESC;

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

SELECT count(\*)

FROM forestation

WHERE year = 2016 AND

perc\_land\_forest >

(SELECT perc\_land\_forest

FROM forestation

WHERE country\_name = 'United States' AND year = 2016);