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 in 1990. As of 2016, the most recent year for which data was available, that number had fallen to39958245.9, a loss of 1324449, 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% 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 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 Latin America & Caribbean (dropped from 51.03% to 46.16%) and Sub-Saharan Africa (30.67% to 28.79%). 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 527229.06 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 79200.00 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 |
| Brazil | Latin America & Caribbean | 541510.00 |
| Indonesia | East Asia & Pacific | 282193.98 |
| Myanmar | East Asia & Pacific | 107234.00 |
| Nigeria | Sub-Saharan Africa | 106506.00 |
| Tanzania | Sub-Saharan Africa | 102320.00 |

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 percentage 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 1 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 |
| American Samoa | East Asia & Pacific | 88 |
| Micronesia, Fed. Sts. | East Asia & Pacific | 92 |
| Gabon | Sub-Saharan Africa | 90 |
| Guyana | Latin America & Caribbean | 84 |
| Lao PDR | East Asia & Pacific | 82 |
| Palau | East Asia & Pacific | 88 |
| Solomon Islands | East Asia & Pacific | 78 |
| Suriname | Latin America & Caribbean | 98 |
| Seychelles | Sub-Saharan Africa | 88 |

## 4. RECOMMENDATIONS

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

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

*Global forest coverage declined by approximately 3.02% between 1990 and 2016. This reduction can be attributed to several factors, including illegal logging, corruption, climate change, exploitation of natural resources, and overgrazing.*

*While most regions have seen an increase in forest cover, two areas—Latin America & the Caribbean, and Sub-Saharan Africa—have experienced a significant decline.*

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

*Based on the data we should focused on countries countries with the highest percentage reduction in forest area from 1990 to 2016: Togo, Nigeria, Uganda, Honduras and Mauritania.Countries in Latin America, such as Brazil, have also experienced notable deforestation.*

*Priority should be given to developing nations, as deforestation in these areas is often driven by systemic issues such as corruption, lack of environmental education etc.*

## 5. APPENDIX: SQL Queries Used

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PROJECT INTRODUCTION

Steps to Complete

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

The forest\_area and land\_area tables join on both country\_code AND year.

The regions table joins these based on only country\_code.

In the ‘forestation’ View, include the following:

All of the columns of the origin tables

A new column that provides the percent of the land area that is designated as forest.

Keep in mind that the column forest\_area\_sqkm in the forest\_area table and the land\_area\_sqmi in the land\_area table are in different units (square kilometers and square miles, respectively), so an adjustment will need to be made in the calculation you write (1 sq mi = 2.59 sq km).

\*/

--DROP VIEW forestation;

CREATE VIEW forestation AS

SELECT f.\*, l.total\_area\_sq\_mi, r.region, r.income\_group, (f.forest\_area\_sqkm/(l.total\_area\_sq\_mi\*2.59))\*100 AS perc\_land\_forest FROM forest\_area as f

JOIN land\_area as l ON f.country\_code = l.country\_code AND f.year = l.year

JOIN regions as r ON f.country\_code = r.country\_code;

/\*\*\*\*\*\*

Part 1 - 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.

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 year, forest\_area\_sqkm

FROM forestation

WHERE country\_name = 'World' AND year in (1990, 2016);

/\*

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

\*/

WITH t1990 AS(

SELECT forest\_area\_sqkm as forest\_area\_sqkm\_1990

FROM forestation

WHERE country\_name = 'World' AND year =1990

),

t2016 AS(

SELECT forest\_area\_sqkm as forest\_area\_sqkm\_2016

FROM forestation

WHERE country\_name = 'World' AND year =2016

)

SELECT t1990.forest\_area\_sqkm\_1990 - t2016.forest\_area\_sqkm\_2016

FROM t1990, t2016; /\*

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

\*/

SELECT (t1990.forest\_area\_sqkm - t2016.forest\_area\_sqkm)/t1990.forest\_area\_sqkm\*100

FROM forestation t1990

INNER JOIN forestation t2016

ON t1990.country\_name = t2016.country\_name

AND (t1990.year = 1990 AND t2016.year = 2016)

AND (t1990.country\_name = 'World' AND t2016.country\_name = 'World');

/\*

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 country\_name, (total\_area\_sq\_mi\*2.59) total\_area\_sq\_km

FROM forestation

WHERE year = 2016 AND total\_area\_sq\_mi\*2.59 BETWEEN 1200000 AND 1448898

ORDER BY total\_area\_sq\_mi\*2.59;

/\*\*\*\*\*\*

Part 2 - Regional Outlook

Create a table that shows the Regions and their percent forest area (sum of forest area divided by the sum of land area) in 1990 and 2016. (Note that 1 sq mi = 2.59 sq km). \*\*\*\*\*\*\*\*/

--DROP TABLE region\_forest;

CREATE TABLE region\_forest AS

SELECT region, year, (sum(forest\_area\_sqkm)/sum(total\_area\_sq\_mi\*2.59))\*100 AS perc\_forest\_region FROM forestation

GROUP BY region, year

HAVING year in (1990, 2016) ;

/\*

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?

\*/

SELECT region, ROUND(CAST(perc\_forest\_region AS NUMERIC), 2)

FROM region\_forest

WHERE year = 2016

ORDER BY perc\_forest\_region ; /\*

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?

\*/

SELECT region, ROUND(CAST(perc\_forest\_region AS NUMERIC), 2)

FROM region\_forest

WHERE year = 1990

ORDER BY perc\_forest\_region ;

/\*

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

WITH t2016 AS(

SELECT region, perc\_forest\_region AS perc\_forest\_region\_16

FROM region\_forest

WHERE year = 2016

),

t1990 AS(

SELECT region, perc\_forest\_region AS perc\_forest\_region\_90

FROM region\_forest

WHERE year = 1990

)

SELECT t1990.region, ROUND(CAST(t1990.perc\_forest\_region\_90 AS NUMERIC), 2) AS Forest\_perc\_90, ROUND(CAST(t2016.perc\_forest\_region\_16 AS NUMERIC), 2) as Forest\_perc\_16

FROM t1990 t1990

LEFT JOIN t2016 t2016 ON t1990.region = t2016.region

ORDER BY region;

/\*\*\*\*\*\*

Part 3 - 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 f\_90.country\_name, ROUND(CAST(((f\_16.forest\_area\_sqkm-f\_90.forest\_area\_sqkm)) AS NUMERIC),2) AS difference

FROM (SELECT country\_name, forest\_area\_sqkm

FROM forestation

WHERE year = '1990'

AND forest\_area\_sqkm IS NOT NULL

AND country\_name <> 'World') f\_90

JOIN (SELECT country\_name, forest\_area\_sqkm

FROM forestation

WHERE year = '2016'

AND forest\_area\_sqkm IS NOT NULL

AND country\_name <> 'World') f\_16

ON (f\_90.country\_name = f\_16.country\_name)

ORDER BY difference DESC 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?

\*/

SELECT f\_90.country\_name, ROUND(CAST(((f\_16.forest\_area\_sqkm-f\_90.forest\_area\_sqkm)/f\_90.forest\_area\_sqkm)\*100 AS NUMERIC),2) AS difference

FROM (SELECT country\_name, forest\_area\_sqkm

FROM forestation

WHERE year = '1990'

AND forest\_area\_sqkm IS NOT NULL

AND country\_name <> 'World') f\_90

JOIN (SELECT country\_name, forest\_area\_sqkm

FROM forestation

WHERE year = '2016'

AND forest\_area\_sqkm IS NOT NULL

AND country\_name <> 'World') f\_16

ON (f\_90.country\_name = f\_16.country\_name)

ORDER BY difference DESC LIMIT 5;

/\*Top 5 decrease

\*/

SELECT f\_90.country\_name, f\_90.region, ROUND(CAST(((f\_16.forest\_area\_sqkm-f\_90.forest\_area\_sqkm)) AS NUMERIC),2) AS difference

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

FROM forestation

WHERE year = '1990'

AND forest\_area\_sqkm IS NOT NULL

AND country\_name <> 'World') f\_90

JOIN (SELECT country\_name, forest\_area\_sqkm

FROM forestation

WHERE year = '2016'

AND forest\_area\_sqkm IS NOT NULL

AND country\_name <> 'World') f\_16

ON (f\_90.country\_name = f\_16.country\_name)

ORDER BY difference LIMIT 5;

/\*Top 5 pecentage decrease

\*/

SELECT f\_90.country\_name, f\_90.region, ROUND(CAST(((f\_16.forest\_area\_sqkm-f\_90.forest\_area\_sqkm)/f\_90.forest\_area\_sqkm)\*100 AS NUMERIC),2) AS difference

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

FROM forestation

WHERE year = '1990'

AND forest\_area\_sqkm IS NOT NULL

AND country\_name <> 'World') f\_90

JOIN (SELECT country\_name, forest\_area\_sqkm

FROM forestation

WHERE year = '2016'

AND forest\_area\_sqkm IS NOT NULL

AND country\_name <> 'World') f\_16

ON (f\_90.country\_name = f\_16.country\_name)

ORDER BY difference LIMIT 5;

/\*

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

\*/

WITH perc as(SELECT country\_name,

CASE WHEN perc\_land\_forest < 25 THEN 1

WHEN perc\_land\_forest >= 25 AND perc\_land\_forest < 50 THEN 2

WHEN perc\_land\_forest >= 50 AND perc\_land\_forest < 75 THEN 3

ELSE 4 END AS quartile

FROM forestation

WHERE year = 2016

AND perc\_land\_forest IS NOT NULL)

SELECT quartile, count(quartile)

FROM perc

GROUP BY quartile

ORDER BY quartile;

/\*

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

\*/

WITH perc as(SELECT country\_name, region, ROUND(perc\_land\_forest) AS perc\_land\_forest,

CASE WHEN perc\_land\_forest < 25 THEN 1

WHEN perc\_land\_forest >= 25 AND perc\_land\_forest < 50 THEN 2

WHEN perc\_land\_forest >= 50 AND perc\_land\_forest < 75 THEN 3

ELSE 4 END AS quartile

FROM forestation

WHERE year = 2016

AND perc\_land\_forest IS NOT NULL)

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

FROM perc

WHERE quartile = 4

;

/\*

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

\*/

SELECT count(country\_name)

FROM forestation

WHERE perc\_land\_forest > (SELECT perc\_land\_forest FROM forestation

WHERE country\_name = 'United States'

AND year = '2016')

AND year = '2016';