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 41,282,694.9 sq. km in 1990. As of 2016, the most recent year for which data was available, that number had fallen to39,958,245.9 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 1,280,000 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 46.14%, 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 51.08%, and the region with the lowest relative forestation was Middle East & North Africa, with 1.77% forestation.

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

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

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 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 China.

China and the U.S. 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 Sq. Km |
| Indonesia | East Asia & Pacific | -282193.98 Sq. Km |
| Myanmar | East Asia & Pacific | -107234 Sq. Km |
| Nigeria | Sub-Saharan Africa | -106506 Sq. Km |
| Tanzania | Sub-Saharan Africa | -102320 Sq. Km |

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 | -59.27% |
| 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 first (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 (%) |
| 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 |

## 

## 4. 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?*

ANS:

**Q1.** *What have you learned from the World Bank data?*

By analyzing the World Bank data, I’ve learned that there is a global decrease in forest area of 3.31% from 1990 to 2016, while the decrease in % forestation is about 1.06%, dropping from 32.41% in 1990 to 31.38% in 2016. Despite the overall drop, it is encouraging to know that only 2 out of the 7 regions of the world, namely Sub-Saharan Africa and Latin America & Caribbean, are declining in % forestation levels, while that of all other regions have actually increased overall.

From 1990 to 2016, China’s forest area increased by 527229 sq. km as the country with the highest growth in forest area, while the US comes in second with 79200 sq. km. That being said, there are still 94 countries with higher forest percentage than the United States. Iceland saw the world’s largest increase in % forest by 213%, indicating a 4x growth in the country’s forest area from 1990 to 2016.

**Q2.** *Which countries should we focus on over others?*

From a regional perspective, efforts should be focused primarily on Sub-Saharan Africa and Latin America & Caribbean as these two regions are the only regions seeing an overall decrease in % forestation. Within Sub-Saharan Africa, the countries of Togo, Nigeria, Uganda and Mauritania have the largest global drop in % forestation. Latin America & Caribbean is the region with the largest drop in % forestation at 4.94%, where the main contributors of this drop is observed in Brazil and Honduras. Brazil has the world’s largest absolute forest area change at 541510 Sq. Km, while Honduras has the world’s 5th largest % forest area change at 45.03%.

## 4. APPENDIX

--Creating VIEW for forestation  
CREATE VIEW forestation AS  
SELECT fa.country\_name AS country\_name,  
 r.region AS region,  
 fa.year AS year,  
 fa.forest\_area\_sqkm AS forest\_area\_sqkm,  
 la.total\_area\_sq\_mi \* 2.59 AS total\_area\_sqkm,  
 ROUND((fa.forest\_area\_sqkm/(la.total\_area\_sq\_mi\*2.59)\*100)::numeric, 2) AS percent\_forest  
FROM forest\_area fa  
JOIN land\_area la  
ON fa.country\_code = la.country\_code AND fa.year = la.year  
JOIN regions r  
ON r.country\_code = la.country\_code AND r.country\_code = fa.country\_code  
GROUP BY 1,2,3,4,5  
ORDER BY 2,3,1,6;  
  
-- Part 1  
  
-- Question 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 year,  
 forest\_area\_sqkm  
FROM forestation  
WHERE year = '1990' AND country\_name = 'World';  
  
-- Question 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 year = '2016' AND country\_name = 'World';  
  
--Question c. What was the change (in sq km) in the forest area of the world from 1990 to 2016?  
WITH total\_2016 AS (SELECT country\_name,  
 year,  
 forest\_area\_sqkm  
 FROM forestation  
 WHERE year = '2016' AND country\_name = 'World'),  
  
 total\_1990 AS (SELECT country\_name,  
 year,  
 forest\_area\_sqkm  
 FROM forestation  
 WHERE year = '1990' AND country\_name = 'World')  
SELECT (a.forest\_area\_sqkm - b.forest\_area\_sqkm) AS world\_forest\_area\_change  
FROM total\_1990 AS a  
INNER JOIN total\_2016 AS b  
ON a.country\_name = b.country\_name;  
  
--Question d. What was the percent change in forest area of the world between 1990 and 2016?  
WITH total\_2016 AS (SELECT country\_name,  
 year,  
 forest\_area\_sqkm  
 FROM forestation  
 WHERE year = '2016' AND country\_name = 'World'),  
 total\_1990 AS (SELECT country\_name,  
 year,  
 forest\_area\_sqkm  
 FROM forestation  
 WHERE year = '1990' AND country\_name = 'World')  
SELECT (a.forest\_area\_sqkm - b.forest\_area\_sqkm)/a.forest\_area\_sqkm\*100 AS world\_forest\_area\_percent\_change  
FROM total\_1990 AS a  
INNER JOIN total\_2016 AS b  
ON a.country\_name = b.country\_name;  
  
  
--Question 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\_sqkm  
FROM forestation  
WHERE (total\_area\_sq\_mi \* 2.59) <= (WITH total\_2016 AS (SELECT country\_name,  
 year,  
 forest\_area\_sqkm  
 FROM forestation  
 WHERE year = '2016' AND country\_name = 'World'),  
  
 total\_1990 AS (SELECT country\_name,  
 year,  
 forest\_area\_sqkm  
 FROM forestation  
 WHERE year = '1990' AND country\_name = 'World')  
 SELECT (a.forest\_area\_sqkm - b.forest\_area\_sqkm )AS world\_forest\_area\_change  
 FROM total\_1990 AS a  
 INNER JOIN total\_2016 AS b  
 ON a.country\_name = b.country\_name) AND year = '2016'  
ORDER BY 2 DESC  
LIMIT 1;  
  
--PART 2  
  
--Creating regional\_outlook table  
CREATE TABLE regional\_outlook AS  
SELECT region,  
 year,  
 ROUND((SUM(forest\_area\_sqkm)\*100/SUM(total\_area\_sqkm))::numeric, 2) AS percent\_forestation  
FROM forestation  
GROUP BY 1, 2;  
  
-- Question 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,  
 percent\_forestation  
FROM regional\_outlook  
WHERE year = '2016'  
ORDER BY 2 DESC;  
  
--Question 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,  
 percent\_forestation  
FROM regional\_outlook  
WHERE year = '1990'  
ORDER BY 2 DESC;  
  
--Question c. Based on the table you created, which regions of the world DECREASED in forest area from 1990 to 2016?  
WITH total\_1990 AS (SELECT region,  
 percent\_forestation  
 FROM regional\_outlook  
 WHERE year = '1990'),  
 total\_2016 AS (SELECT region,  
 percent\_forestation  
 FROM regional\_outlook  
 WHERE year = '2016')  
SELECT a.region, CASE WHEN (b.percent\_forestation - a.percent\_forestation) < 0 THEN 'Decrease' ELSE 'Increased' END AS trend  
FROM total\_1990 AS a  
INNER JOIN total\_2016 AS b  
ON a.region = b.region  
WHERE a.region != 'World' AND b.region != 'World'  
GROUP BY 1,2;  
  
--Part 3  
  
--Question 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 old AS (SELECT country\_name,  
 region,  
 year,  
 forest\_area\_sqkm  
 FROM forestation  
 WHERE year = '1990'),  
  
 new AS (SELECT country\_name,  
 year,  
 region,  
 forest\_area\_sqkm  
 FROM forestation  
 WHERE year = '2016')  
  
SELECT a.country\_name AS "Country Name",  
 a.region,  
 (a.forest\_area\_sqkm - b.forest\_area\_sqkm) AS "Difference in Total Forest Area (sq. km)"  
FROM new AS a  
INNER JOIN old AS b  
ON a.country\_name = b.country\_name  
WHERE (a.forest\_area\_sqkm - b.forest\_area\_sqkm) IS NOT NULL  
 AND a.country\_name != 'World'  
ORDER BY 3  
LIMIT 5;  
  
  
--Question 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 old AS (SELECT country\_name,  
 year,  
 region,  
 forest\_area\_sqkm  
 FROM forestation  
 WHERE year = '1990'),  
  
 new AS (SELECT country\_name,  
 year,  
 region,  
 forest\_area\_sqkm  
 FROM forestation  
 WHERE year = '2016')  
  
SELECT a.country\_name AS "Country Name",  
 a.region AS "Region",  
 ROUND(((a.forest\_area\_sqkm - b.forest\_area\_sqkm)/b.forest\_area\_sqkm\*100)::numeric, 2) AS "Change in Total Forest Area (%)"  
FROM new AS a  
INNER JOIN old AS b  
ON a.country\_name = b.country\_name  
WHERE ((a.forest\_area\_sqkm - b.forest\_area\_sqkm)/b.forest\_area\_sqkm\*100) IS NOT NULL  
 AND a.country\_name != 'World'  
ORDER BY 3  
LIMIT 5;  
  
--Question c. If countries were grouped by percent forestation in quartiles, which group had the most countries in it in 2016?  
WITH t1 AS (SELECT country\_name,  
 percent\_forest,  
 CASE  
 WHEN percent\_forest >= 0 AND percent\_forest <= 25 THEN 1  
 WHEN percent\_forest > 25 AND percent\_forest <= 50 THEN 2  
 WHEN percent\_forest > 50 AND percent\_forest <= 75 THEN 3  
 ELSE 4  
 END AS quartile  
 FROM forestation  
 WHERE year = '2016'  
 AND percent\_forest IS NOT NULL  
 AND country\_name != 'World')  
SELECT quartile,  
 COUNT(quartile) count  
FROM t1  
GROUP BY 1  
ORDER BY 1;  
  
--Question d. List all of the countries that were in the 4th quartile (percent forest > 75%) in 2016.  
SELECT country\_name,  
 region,  
 percent\_forest  
FROM forestation  
WHERE year = '2016'  
 AND country\_name != 'World'  
 AND percent\_forest IS NOT NULL  
 AND percent\_forest >= 75  
ORDER BY 3;  
  
--Question e. How many countries had a percent forestation higher than the United States in 2016?  
SELECT COUNT(\*)  
FROM forestation  
WHERE percent\_forest > (SELECT percent\_forest  
 FROM forestation  
 WHERE year = '2016'  
 AND country\_name = 'United States')  
 AND year = '2016';