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 3.20824258980244%.

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).

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

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 527229.062. 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, 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 |
| Indonesia | East Asia & Pacific | 282193.9844 |
| Myanmar | East Asia & Pacific | 107234.0039 |
| Nigeria | Sub-Saharan Africa | 106506.00098 |
| 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 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 |
| 0-25% | 85 |
| 25-50% | 73 |
| 50-75% | 38 |
| 75-100% | 9 |

The largest number of countries in 2016 were found in the 0-25% 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 | 98.2576939676578 |
| Micronesia, Fed. Sts. | East Asia & Pacific | 91.8572390715248 |
| Gabon | Sub-Saharan Africa | 90.0376418700565 |
| Seychelles | Sub-Saharan Africa | 88.4111367385789 |
| Palau | East Asia & Pacific | 87.6068085491204 |
| American Samoa | East Asia & Pacific | 87.5000875000875 |
| Guyana | Latin America & Caribbean | 83.9014489110682 |
| Lao PDR | East Asia & Pacific | 82.1082317640861 |
| Solomon Islands | East Asia & Pacific | 77.8635177945066 |

## 4. RECOMMENDATIONS

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

* *What have you learned from the World Bank data?* 
  + *The decline in global forest area from 1990 to 2016 underlines the substantial loss of forests in Latin America and the Caribbean, as well as Sub-Saharan Africa. It's worth noting that despite this concerning trend, many regions around the world have shown positive developments in their forested areas. Notably, Europe and Central Asia, North America, East Asia and the Pacific, South Asia, and the Middle East and North Africa have all demonstrated an increase in both forested area and forest area percentage. This encouraging trend reflects their commitment to forest conservation and sustainable growth.*
* *Which countries should we focus on over others?*
  + *Evidently, a strategic focus on countries that have witnessed the most substantial reductions in forested areas, both in terms of percentage and total amount, is the most prudent approach. According to the findings in Table 3.2, Togo, Nigeria, Uganda, Mauritania, and Honduras are notable for the highest percentage decreases. Meanwhile, Table 3.1 identifies Brazil, Indonesia, Myanmar, Nigeria, and Tanzania as the countries with the most significant absolute decreases in forest area.*

## 

## 5. APPENDIX: SQL Queries Used

Create a view:

**CREATE VIEW forestation**

**AS**

**SELECT f.country\_code**

**,f.country\_name**

**,f.year**

**,f.forest\_area\_sqkm**

**,l.total\_area\_sq\_mi \* 2.59 AS total\_area\_sqkm**

**,r.region**

**,r.income\_group**

**,(f.forest\_area\_sqkm / (l.total\_area\_sq\_mi \* 2.59)) \* 100 AS perc\_forest\_area**

**FROM forest\_area f**

**INNER JOIN land\_area l ON f.country\_code = l.country\_code**

**AND f.year = l.year**

**INNER JOIN regions r ON r.country\_code = f.country\_code**

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.

**SELECT SUM(forest\_area\_sqkm)**

**FROM forestation**

**WHERE country\_name = 'World'**

**AND 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.”

**SELECT SUM(forest\_area\_sqkm)**

**FROM forestation**

**WHERE country\_name = 'World'**

**AND year = 2016**

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

**SELECT A.forest\_area\_sqkm - B.forest\_area\_sqkm AS diff**

**FROM forestation A**

**INNER JOIN forestation B ON A.country\_code = B.country\_code**

**WHERE A.country\_name = 'World'**

**AND A.year = 1990**

**AND B.year = 2016**

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

**SELECT (A.forest\_area\_sqkm - B.forest\_area\_sqkm) / A.forest\_area\_sqkm \* 100 AS perc\_diff**

**FROM forestation A**

**INNER JOIN forestation B ON A.country\_code = B.country\_code**

**WHERE A.country\_name = 'World'**

**AND A.year = 1990**

**AND B.year = 2016**

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?

**WITH V1**

**AS (**

**SELECT SUM(forest\_area\_sqkm) AS forest\_area\_sqkm\_1990**

**FROM forestation**

**WHERE country\_name = 'World'**

**AND year = 1990**

**)**

**,V2**

**AS (**

**SELECT SUM(forest\_area\_sqkm) AS forest\_area\_sqkm\_2016**

**FROM forestation**

**WHERE country\_name = 'World'**

**AND year = 2016**

**)**

**,V3**

**AS (**

**SELECT (forest\_area\_sqkm\_1990 - forest\_area\_sqkm\_2016) AS diff**

**FROM V1,V2**

**)**

**SELECT country\_name**

**,forest\_area\_sqkm**

**,ABS(forest\_area\_sqkm - (SELECT \* FROM V3)) AS diff**

**FROM forestation**

**ORDER BY 3 ASC LIMIT 1**

2. REGIONAL OUTLOOK

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?

**WITH V1**

**AS (**

**SELECT region**

**,year**

**,ROUND(CAST(SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) \* 100 AS NUMERIC), 2) AS perc**

**FROM forestation**

**GROUP BY 1,2**

**HAVING year >= 1990**

**AND year <= 2016**

**)**

**SELECT \***

**FROM V1**

**WHERE region = 'World'**

**AND year = 2016**

**WITH V1 AS (**

**SELECT region**

**,year**

**,ROUND(CAST(SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) \* 100 AS NUMERIC), 2) AS perc**

**FROM forestation**

**GROUP BY 1,2**

**HAVING year >= 1990**

**AND year <= 2016**

**)**

**SELECT \***

**FROM V1**

**WHERE year = 2016**

**ORDER BY perc DESC LIMIT 1**

**WITH V1 AS (**

**SELECT region**

**,year**

**,ROUND(CAST(SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) \* 100 AS NUMERIC), 2) AS perc**

**FROM forestation**

**GROUP BY 1,2**

**HAVING year >= 1990**

**AND year <= 2016**

**)**

**SELECT \***

**FROM V1**

**WHERE year = 2016**

**ORDER BY perc ASC 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?

**WITH V1**

**AS (**

**SELECT region**

**,year**

**,ROUND(CAST(SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) \* 100 AS NUMERIC), 2) AS perc**

**FROM forestation**

**GROUP BY 1,2**

**HAVING year >= 1990**

**AND year <= 2016**

**)**

**SELECT \***

**FROM V1**

**WHERE region = 'World'**

**AND year = 1990**

**WITH V1 AS (**

**SELECT region**

**,year**

**,ROUND(CAST(SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) \* 100 AS NUMERIC), 2) AS perc**

**FROM forestation**

**GROUP BY 1,2**

**HAVING year >= 1990**

**AND year <= 2016**

**)**

**SELECT \***

**FROM V1**

**WHERE year = 1990**

**ORDER BY perc DESC LIMIT 1**

**WITH V1 AS (**

**SELECT region**

**,year**

**,ROUND(CAST(SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) \* 100 AS NUMERIC), 2) AS perc**

**FROM forestation**

**GROUP BY 1,2**

**HAVING year >= 1990**

**AND year <= 2016**

**)**

**SELECT \***

**FROM V1**

**WHERE year = 1990**

**ORDER BY perc ASC**

**LIMIT 1**

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

**WITH V1**

**AS (**

**SELECT region**

**,year**

**,ROUND(CAST(SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) \* 100 AS NUMERIC), 2) AS perc**

**FROM forestation**

**GROUP BY 1,2**

**HAVING year >= 1990**

**AND year <= 2016**

**)**

**,V2**

**AS (**

**SELECT \***

**FROM V1**

**WHERE year = 1990**

**)**

**,V3**

**AS (**

**SELECT \***

**FROM V1**

**WHERE year = 2016**

**)**

**SELECT V2.region**

**,V2.perc AS perc\_1990**

**,V3.perc AS perc\_2016**

**,(V3.perc - V2.perc) AS diff**

**FROM V2**

**INNER JOIN V3 ON V2.region = V3.region**

**ORDER BY 4 ASC**

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?

**WITH V1**

**AS (**

**SELECT country\_name**

**,year**

**,region**

**,SUM(forest\_area\_sqkm) AS forest\_area\_sqkm\_1990**

**FROM forestation**

**GROUP BY 1,2,3**

**HAVING year = 1990**

**)**

**,V2**

**AS (**

**SELECT country\_name**

**,year**

**,region**

**,SUM(forest\_area\_sqkm) AS forest\_area\_sqkm\_2016**

**FROM forestation**

**GROUP BY 1,2,3**

**HAVING year = 2016**

**)**

**SELECT V1.country\_name**

**,V1.region**

**,V1.forest\_area\_sqkm\_1990**

**,V2.forest\_area\_sqkm\_2016**

**,(V1.forest\_area\_sqkm\_1990 - V2.forest\_area\_sqkm\_2016) AS diff**

**,(V1.forest\_area\_sqkm\_1990 - V2.forest\_area\_sqkm\_2016) / V1.forest\_area\_sqkm\_1990 \* 100 AS perc**

**FROM V1**

**INNER JOIN V2 ON V1.country\_name = V2.country\_name**

**WHERE V1.forest\_area\_sqkm\_1990 IS NOT NULL**

**AND V2.forest\_area\_sqkm\_2016 IS NOT NULL**

**ORDER BY 5 DESC**

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 V1**

**AS (**

**SELECT country\_name**

**,year**

**,region**

**,SUM(forest\_area\_sqkm) AS forest\_area\_sqkm\_1990**

**FROM forestation**

**GROUP BY 1,2,3**

**HAVING year = 1990**

**)**

**,V2**

**AS (**

**SELECT country\_name**

**,year**

**,region**

**,SUM(forest\_area\_sqkm) AS forest\_area\_sqkm\_2016**

**FROM forestation**

**GROUP BY 1,2,3**

**HAVING year = 2016**

**)**

**SELECT V1.country\_name**

**,V1.region**

**,V1.forest\_area\_sqkm\_1990**

**,V2.forest\_area\_sqkm\_2016**

**,(V1.forest\_area\_sqkm\_1990 - V2.forest\_area\_sqkm\_2016) AS diff**

**,ROUND(CAST((V1.forest\_area\_sqkm\_1990 - V2.forest\_area\_sqkm\_2016) / V1.forest\_area\_sqkm\_1990 \* 100 AS NUMERIC), 2) AS perc**

**FROM V1**

**INNER JOIN V2 ON V1.country\_name = V2.country\_name**

**WHERE V1.forest\_area\_sqkm\_1990 IS NOT NULL**

**AND V2.forest\_area\_sqkm\_2016 IS NOT NULL**

**ORDER BY 6 DESC**

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

**WITH V1**

**AS (**

**SELECT country\_name**

**,CASE**

**WHEN perc\_forest\_area < 25**

**THEN '0-25%'**

**WHEN perc\_forest\_area >= 25**

**AND perc\_forest\_area < 50**

**THEN '25-50%'**

**WHEN perc\_forest\_area >= 50**

**AND perc\_forest\_area < 75**

**THEN '50-75%'**

**ELSE '75-100%'**

**END AS percentiles**

**FROM forestation**

**WHERE year = 2016**

**)**

**SELECT percentiles**

**,COUNT(\*)**

**FROM V1**

**GROUP BY 1**

**ORDER BY 2 DESC**

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

**WITH V1**

**AS (**

**SELECT country\_name**

**,region**

**,perc\_forest\_area**

**,CASE**

**WHEN perc\_forest\_area < 25**

**THEN '0-25%'**

**WHEN perc\_forest\_area >= 25**

**AND perc\_forest\_area < 50**

**THEN '25-50%'**

**WHEN perc\_forest\_area >= 50**

**AND perc\_forest\_area < 75**

**THEN '50-75%'**

**ELSE '75-100%'**

**END AS percentiles**

**FROM forestation**

**WHERE year = 2016**

**AND perc\_forest\_area IS NOT NULL**

**)**

**SELECT \***

**FROM V1**

**WHERE percentiles = '75-100%'**

**ORDER BY 3 DESC**

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

**WITH V1**

**AS (**

**SELECT perc\_forest\_area**

**FROM forestation**

**WHERE year = 2016**

**AND country\_name = 'United States'**

**)**

**SELECT COUNT(\*)**

**FROM forestation**

**WHERE perc\_forest\_area > (SELECT \* FROM V1)**