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 km²** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9 km²**, a loss of **1324449 km²**, 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 **1324449 km²** ).

## 2. **REGIONAL OUTLOOK**

In 2016, the percent of the total land area of the world designated as forest was **31.37%.** The region with the highest relative forestation was **Latin America & Caribbean**, with **46%** and the region with the lowest relative forestation was the **Middle East & North Africa**, with **2.06 %** 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 **32.42 %**, and the region with the lowest relative forestation was the **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** |
| Middle East & North Africa | 1.77524062469353 | 2.06826486871501 |
| South Asia | 16.510767001421 | 17.5058634081534 |
| East Asia & Pacific | 25.7760953973175 | 26.3586765000485 |
| Sub-Saharan Africa | 30.6741454610006 | 28.7881883550464 |
| North America | 35.6511790009015 | 36.0393609681438 |
| Europe & Central Asia | 37.2839398564019 | 38.0414216032517 |
| Latin America & Caribbean | 51.0299798667514 | 46.1620721996047 |

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 **28.78 %**) and **Latin America & Caribbean** (**51.02 %** 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 **31.37%**.

## 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 km²**. 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 km²**, much lower than the figure for **China**.

**United States** and **China** 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 **213.666 %** 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 | 75.4452559270073 |
| Nigeria | Sub-Saharan Africa | 61.7999309388418 |
| Uganda | Sub-Saharan Africa | 59.1286034729531 |
| Mauritania | Sub-Saharan Africa | 46.7469879518072 |
| Honduras | Latin America & Caribbean | 45.0344149459194 |

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 |
| 1st (0-25)%) | 85 |
| 2nd (25-50%) | 72 |
| 3rd (50-75%) | 38 |
| 4th (75-100%) | 9 |

The largest number of countries in 2016 were found in the **1st** 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 |

## 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?*

After having analyzed the data from the World Bank, the ForestQuery team noticed that despite the world loss of 3.2 % of it’s forest area from 1990 to 2016, countries like China, the United States, and India increased the amount of forest area.

The environment is indeed suffering from the increase of deforestation, but as we can see, some efforts to remedy the situation have been taking place. These countries provide an example to be followed by countries where the decrease of forestation is significant.

As we stated in the above analysis, some countries from the region of Sub-Saharan Africa have the highest percent decrease in forest areas. It seems that countries from less-developed regions have the challenge of deciding if they would continue to exploit their natural ressources to better their economy, or find alternatives in order to fight poverty without negatively affecting the environment.

## 6. APPENDIX: SQL queries used

**/\* View \*/**

CREATE VIEW forestation

AS

SELECT f.\*,

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 \* 2.5) \* 100 AS forest\_percentage

FROM forest\_area f

JOIN land\_area l

ON f.country\_code = l.country\_code

AND f.year = l.year

JOIN regions r

ON r.country\_code = l.country\_code;

**/\* Global Situation \*/**

-- a. What was the total forest area (in sq km) of the world in 1990?

SELECT forest\_area\_sqkm

FROM forestation

WHERE year = '1990' AND region = 'World';

--41282694.9

-- b. What was the total forest area (in sq km) of the world in 2016?

SELECT forest\_area\_sqkm

FROM forestation

WHERE year = '2016' AND region = 'World';

--39958245.9

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

SELECT (f1.forest\_area\_sqkm - f2.forest\_area\_sqkm)

AS forest\_area\_difference

FROM forestation f1

JOIN forestation f2

ON f1.country\_name = f2.country\_name

WHERE f1.year = '1990' AND f2.year = '2016' AND f1.region = 'World';

--1324449

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

SELECT (forest\_area\_sqkm - (SELECT forest\_area\_sqkm

FROM forestation

WHERE (year = '2016' AND region = 'World')))

/ forest\_area\_sqkm \* 100

AS forest\_area\_difference

FROM forestation

WHERE year = '1990' AND region = 'World'

-- 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?

SELECT country\_name, total\_area\_sqkm

FROM forestation

WHERE year = '2016'

AND total\_area\_sqkm < (

SELECT ABS(f1.forest\_area\_sqkm - f2.forest\_area\_sqkm)

AS forest\_area\_difference

FROM forestation f1

JOIN forestation f2

ON f1.country\_name = f2.country\_name

WHERE f1.year = '1990'

AND f2.year = '2016'

AND f1.region = 'World'

)

ORDER BY 2 DESC

LIMIT 1;

--Peru 1279999.9891

**/\* Regional Outlook \*/**

-- a. What was the percent forest of the entire world in 2016? Which region had the highest pecent forest in 2016, and which had the lowest, to 2 decimal places?

SELECT region,

year,

SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) \* 100

AS percent\_forest

FROM forestation

WHERE year = '2016'

GROUP BY region, year

ORDER BY percent\_forest;

-- World: 31.37; high: Latin America 46.16 lowest: Middle East 2.06

-- b. What was the percent forest of the entire world in 1990? Which region had the highest pecent forest in 1990, and which had the lowest, to 2 decimal places?

SELECT region,

year,

SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) \* 100

AS percent\_forest

FROM forestation

WHERE year = '1990'

GROUP BY region, year

ORDER BY percent\_forest;

--World: 32.42; highest: Latin America 32.42; Lowest: Middle East 1.77

-- c. Which regions of the world decreased in forest area from 1990 to 2016?

WITH t1 AS (

SELECT region, year,

SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) \* 100

AS percent\_forest

FROM forestation

WHERE year = '1990'

GROUP BY region, year),

t2 AS (SELECT region, year,

SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) \* 100

AS percent\_forest

FROM forestation

WHERE year = '2016'

GROUP BY region, year)

SELECT t1.region,

t1.percent\_forest AS percent\_forest\_1990,

t2.percent\_forest AS percent\_forest\_2016,

CASE WHEN (t2.percent\_forest - t1.percent\_forest) <= 0

THEN 'decrease' ELSE 'increase' END AS change

FROM t1

JOIN t2

ON t2.region = t1.region

ORDER BY change;

--Sub-Saharan Africa 30.67 -> 28.78; Latin America & Caribb 51.09 -> 46.16

**/\* 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 t1 AS (

SELECT country\_name, year,

SUM(forest\_area\_sqkm)

AS total\_forest\_area

FROM forestation

WHERE year = '1990' AND region != 'World'

GROUP BY 1, year),

t2 AS (SELECT country\_name, year,

SUM(forest\_area\_sqkm)

AS total\_forest\_area

FROM forestation

WHERE year = '2016' AND region != 'World'

GROUP BY 1, year)

SELECT t1.country\_name,

t1.total\_forest\_area AS forest\_area\_1990,

t2.total\_forest\_area AS forest\_area\_2016,

t1.total\_forest\_area - t2.total\_forest\_area

AS forest\_area\_difference

FROM t1

JOIN t2

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

WHERE t1.total\_forest\_area IS NOT NULL

AND t2.total\_forest\_area IS NOT NULL

ORDER BY forest\_area\_difference DESC

LIMIT 5;

--Brazil 541510; Indonesia 282193.9844; Myanmar 107234.0039; Nigeria 106506.00098; Tanzania 102320.

-- b. Which 5 countries saw the largest percent decrease in forest area form 1990 to 2016? What was the percent change to 2 decimal places for each?

WITH t1 AS (

SELECT country\_name, year,

SUM(forest\_area\_sqkm)

AS total\_forest\_area

FROM forestation

WHERE year = '1990' AND region != 'World'

GROUP BY 1, year),

t2 AS (SELECT country\_name, year,

SUM(forest\_area\_sqkm)

AS total\_forest\_area

FROM forestation

WHERE year = '2016' AND region != 'World'

GROUP BY 1, year)

SELECT t1.country\_name,

(t1.total\_forest\_area - t2.total\_forest\_area)

/ t1.total\_forest\_area \* 100

AS percent\_change

FROM t1

JOIN t2

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

WHERE t1.total\_forest\_area IS NOT NULL

AND t2.total\_forest\_area IS NOT NULL

ORDER BY 2 DESC

LIMIT 5;

--Togo 75.44, Nigeria 61.79, Uganda 59.12, Mauritania 46.74, Honduras 45.03.

-- 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\_forestation,

CASE WHEN percent\_forestation <= 25 THEN '1st'

WHEN percent\_forestation <= 50 THEN '2nd'

WHEN percent\_forestation <= 75 THEN '3rd'

ELSE '4th' END AS quartiles

FROM (SELECT country\_name,

(forest\_area\_sqkm / total\_area\_sqkm) \* 100

AS percent\_forestation

FROM forestation

WHERE year = '2016' AND region != 'World'

AND forest\_area\_sqkm IS NOT NULL

AND total\_area\_sqkm IS NOT NULL

GROUP BY 1, 2) AS t2

WHERE percent\_forestation IS NOT NULL

GROUP BY 1, 2)

SELECT quartiles, COUNT(\*)

FROM t1

GROUP BY 1

ORDER BY 1;

--group 1 < 25%

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

WITH t1 AS (SELECT country\_name,

percent\_forestation,

CASE WHEN percent\_forestation <= 25 THEN '1st'

WHEN percent\_forestation <= 50 THEN '2nd'

WHEN percent\_forestation <= 75 THEN '3rd'

ELSE '4th' END AS quartiles

FROM (SELECT country\_name,

(forest\_area\_sqkm / total\_area\_sqkm) \* 100

AS percent\_forestation

FROM forestation

WHERE year = '2016' AND region != 'World'

AND forest\_area\_sqkm IS NOT NULL

AND total\_area\_sqkm IS NOT NULL

GROUP BY 1, 2) AS t2

WHERE percent\_forestation IS NOT NULL

GROUP BY 1, 2)

SELECT country\_name

FROM t1

WHERE quartiles = '4th'

GROUP BY 1

ORDER BY 1;

--American Samoa, Gabon, Guyana, Lao PDR, Micronesia Fed. Sts., Palau Seychelles, Solomon Islands, Suriname.

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

SELECT country\_name,

(forest\_area\_sqkm / total\_area\_sqkm) \* 100

AS percent\_forestation

FROM forestation

WHERE year = '2016'

AND region != 'World'

AND ((forest\_area\_sqkm / total\_area\_sqkm) \* 100) > (

SELECT (forest\_area\_sqkm / total\_area\_sqkm) \* 100

AS percent\_forestation

FROM forestation

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

)

AND forest\_area\_sqkm IS NOT NULL

AND total\_area\_sqkm IS NOT NULL;

-- 94