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 3.21 %.

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 |
| Sub-Saharan Africa | 32.19 | 27.56 |
| South Asia | 16.51 | 17.51 |
| North America | 35.65 | 36.04 |
| Middle East & North Africa | 1.78 | 2.07 |
| Latin America & Caribbean | 51.03 | 46.16 |
| Europe & Central Asia | 37.27 | 38.06 |
| East Asia & Pacific | 25.77 | 26.36 |

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 (32.19% to 27.56%). 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 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, 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 343.99 % 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 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 quartile | 87 |
| 2nd quartile | 72 |
| 3rd quartile | 38 |
| 4th quartile | 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 | 98.26 |
| 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 |

## 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?*

Overall the world forestation decreases from 1990 to 2016 and it mainly driven by the biggest area of deforestation region of Latin America & Caribbean and Sub-Saharan Africa. The focus should be in that regions especially with the countries with the largest deforestation in sq km and percentage drop like Brazil and Nigeria. In addition, the biggest sq km deforestation should be considered in Indonesia and Myanmar as the sq km drop could be related to agriculture of palm oil. But overall you see this seems to be related to the region as well, that the most drop in forest area are in the Sub Saharan African countries. I would further analyze if this is related to the income or other factors like global warming, agriculture or overpopulation. I think if we focus on the areas with the biggest absolute deforestation sq km it could minimize the world deforestation. Furthermore, globally speaking you see only a very few countries which are designated to a big proportion of forest in their land area. Unfortunately, 77% (159/206) of all countries are below 50% of forestation. This can be an alarming signal that overall all countries can work on a higher forestation and take Iceland as an pioneer to increase forestation overall.

APPENDIX: CODE

Forestation View

CREATE VIEW forestation as

(SELECT

f.country\_code as code,

f.country\_name as country,

r.region as region,

r.income\_group as income\_group,

f.year as year,

f.forest\_area\_sqkm as f\_area\_sqkm,

l.total\_area\_sq\_mi as l\_area\_sq\_mi,

(f.forest\_area\_sqkm/(l.total\_area\_sq\_mi\*2.59))\*100 as percentage\_forest

FROM Forest\_area f

JOIN land\_area l

ON f.Country\_code = l.country\_code AND f.year = l.year

JOIN regions r

ON f.country\_code = r.country\_code);

Question 1a: What was the total forest area (in sq km) of the world in 1990?

SELECT Sum(f\_area\_Sqkm)

FROM forestation

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

Question 1b: What was the total forest area (in sq km) of the world in 2016?

SELECT Sum(f\_area\_Sqkm)

FROM forestation

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

Question 1c: What was the change (in sq km) in the forest area of the world from 1990 to 2016?

WITH a1 AS

(SELECT \*

FROM forestation

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

UNION

SELECT \*

FROM forestation

WHERE country= 'World' AND year='1990')

SELECT f\_area\_sqkm AS Forest\_area,

year,

LEAD(f\_area\_sqkm) OVER (ORDER BY year) AS lead,

LEAD(f\_area\_sqkm) OVER (ORDER BY year) - f\_area\_sqkm AS lead\_differ,

( (LEAD(f\_area\_sqkm) OVER (ORDER BY year) - f\_area\_sqkm)/(f\_area\_sqkm))\*100 AS change

FROM a1;

Question 1d: What was the percent change in forest area of the world between 1990 and 2016?

WITH a1 AS

(SELECT \*

FROM forestation

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

UNION

SELECT \*

FROM forestation

WHERE country= 'World' AND year='1990'),

a2 AS

(SELECT f\_area\_sqkm AS Forest\_area,

year,

LEAD(f\_area\_sqkm) OVER (ORDER BY year) AS lead,

LEAD(f\_area\_sqkm) OVER (ORDER BY year) - f\_area\_sqkm AS lead\_differ,

((LEAD(f\_area\_sqkm) OVER (ORDER BY year)-f\_area\_sqkm)/(f\_area\_sqkm))\*100 AS change

FROM a1)

SELECT ROUND(CAST(change as numeric),2) as change\_f\_area

FROM a2;

Question 1 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 l\_area\_sq\_mi\*2.59 as land\_area,

country

FROM forestation

WHERE year= '2016' AND (l\_area\_sq\_mi\*2.59) <= 1324449

ORDER BY 1 DESC

LIMIT 1;

2a) 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?

World forestation in 2016

SELECT ROUND(CAST(percentage\_forest AS NUMERIC),2)

FROM forestation

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

Highest and lowest Forestation

Table used for questions below

CREATE TABLE regional\_outlook AS(

SELECT f.year,

r.region,

ROUND(CAST((SUM(f.forest\_area\_sqkm)\*100/SUM(l.total\_area\_sq\_mi \*2.59)) AS NUMERIC),2) AS 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 f.country\_code = r.country\_code

WHERE f.year IN (1990, 2016) AND f.forest\_area\_sqkm IS NOT NULL AND l.total\_area\_sq\_mi IS NOT NULL

GROUP BY 1,2);

SELECT \*

FROM regional\_outlook

WHERE year = 2016 AND NOT region='World'

ORDER BY percentage DESC

LIMIT 1

SELECT \*

FROM regional\_outlook

WHERE year = 2016 AND NOT region='World'

ORDER BY percentage 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

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

HIGEST and LOWEST percent forest

SELECT \*

FROM regional\_outlook

WHERE year = 1990 AND NOT region='World'

ORDER BY percentage DESC

LIMIT 1

SELECT \*

FROM regional\_outlook

WHERE year = 1990 AND NOT region='World'

ORDER BY percentage ASC

LIMIT 1

PERCENT forest of the entire world and Difference of forest percentage

WITH year\_1990 AS

(SELECT year,

region,

percentage as Forest\_Area\_1990

FROM regional\_outlook

WHERE year= 1990),

year\_2016 AS

(SELECT year,

region,

percentage AS Forest\_Area\_2016

FROM regional\_outlook

WHERE year= 2016)

SELECT y1.region,

y2.Forest\_Area\_2016,

y1.Forest\_Area\_1990,

y2.Forest\_Area\_2016-y1.Forest\_Area\_1990 AS period\_Difference

FROM year\_1990 y1

JOIN year\_2016 y2

ON y1.region= y2.region

ORDER BY 4

3) COUNTRY LEVEL DETAIL

SUCCESS

ABSOLUTE TOP 2

WITH f\_2016 AS

(SELECT code,

country,

region,

year,

f\_area\_sqkm AS forest\_Area\_2016,

l\_area\_sq\_mi as l\_area\_2016

FROM forestation

WHERE year='2016' AND f\_area\_sqkm IS NOT NULL AND NOT country='World'),

f\_1990 AS

(SELECT code,

country,

region,

year,

f\_area\_sqkm AS forest\_Area\_1990,

l\_area\_sq\_mi as l\_area\_1990

FROM forestation

WHERE year='1990'AND f\_area\_sqkm IS NOT NULL AND NOT country='World')

SELECT f16.code,

f16.country,

f16.region,

f90.l\_area\_1990,

f16.l\_area\_2016,

f90.forest\_Area\_1990,

f16.forest\_Area\_2016,

(f16.forest\_Area\_2016-f90.forest\_Area\_1990) AS Change, ROUND(CAST(((f16.forest\_Area\_2016-f90.forest\_Area\_1990)\*100/f90.forest\_Area\_1990) AS NUMERIC),2) AS percentage

FROM f\_2016 f16

JOIN f\_1990 f90

ON f16.code = f90.code

ORDER BY change DESC

LIMIT 2

PERCENTAGE CHANGE TOP 1

WITH f\_2016 AS

(SELECT code,

country,

region,

year,

f\_area\_sqkm AS forest\_Area\_2016,

l\_area\_sq\_mi as l\_area\_2016

FROM forestation

WHERE year='2016' AND f\_area\_sqkm IS NOT NULL AND NOT country='World'),

f\_1990 AS

(SELECT code,

country,

region,

year,

f\_area\_sqkm AS forest\_Area\_1990,

l\_area\_sq\_mi as l\_area\_1990

FROM forestation

WHERE year='1990'AND f\_area\_sqkm IS NOT NULL AND NOT country='World')

SELECT f16.code,

f16.country,

f16.region,

f90.l\_area\_1990,

f16.l\_area\_2016,

f90.forest\_Area\_1990,

f16.forest\_Area\_2016,

(f16.forest\_Area\_2016-f90.forest\_Area\_1990) AS Change, ROUND(CAST(((f16.forest\_Area\_2016-f90.forest\_Area\_1990)\*100/f90.forest\_Area\_1990) AS NUMERIC),2) AS percentage

FROM f\_2016 f16

JOIN f\_1990 f90

ON f16.code = f90.code

ORDER BY percentage DESC

LIMIT 1

CONCERNS

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?

Table 3.1

WITH f\_2016 AS

(SELECT code,

country,

region,

year,

f\_area\_sqkm AS forest\_Area\_2016

FROM forestation

WHERE year='2016' AND f\_area\_sqkm IS NOT NULL AND NOT country='World'),

f\_1990 AS

(SELECT code,

country,

region,

year,

f\_area\_sqkm AS forest\_Area\_1990

FROM forestation

WHERE year='1990'AND f\_area\_sqkm IS NOT NULL AND NOT country='World')

SELECT f16.code,

f16.country,

f16.region,

f90.forest\_Area\_1990,

f16.forest\_Area\_2016,

(f16.forest\_Area\_2016-f90.forest\_Area\_1990) AS Change, ROUND(CAST(((f16.forest\_Area\_2016-f90.forest\_Area\_1990)\*100/f90.forest\_Area\_1990) AS NUMERIC),2) AS percentage

FROM f\_2016 f16

JOIN f\_1990 f90

ON f16.code = f90.code

ORDER BY change

LIMIT 5

3b. 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?

Table 3.2.

WITH f\_2016 AS

(SELECT code,

country,

region,

year,

f\_area\_sqkm AS forest\_Area\_2016

FROM forestation

WHERE year='2016' AND f\_area\_sqkm IS NOT NULL AND NOT country='World'),

f\_1990 AS

(SELECT code,

country,

region,

year,

f\_area\_sqkm AS forest\_Area\_1990

FROM forestation

WHERE year='1990'AND f\_area\_sqkm IS NOT NULL AND NOT country='World')

SELECT f16.code,

f16.country,

f16.region,

f90.forest\_Area\_1990,

f16.forest\_Area\_2016,

(f16.forest\_Area\_2016-f90.forest\_Area\_1990) AS Change, ROUND(CAST(((f16.forest\_Area\_2016-f90.forest\_Area\_1990)\*100/f90.forest\_Area\_1990) AS NUMERIC),2) AS percentage

FROM f\_2016 f16

JOIN f\_1990 f90

ON f16.code = f90.code

ORDER BY percentage

LIMIT 5

3c. If countries were grouped by percent forestation in quartiles, which group had the most countries in it in 2016?

Count of Quartiles

WITH sub AS

(SELECT country,

percentage\_forest

FROM forestation

WHERE year='2016' AND f\_area\_sqkm IS NOT NULL AND NOT country ='World'),

sub\_quartiles AS

(SELECT country,

CASE

WHEN percentage\_forest>=75 then '4th quartile'

WHEN percentage\_forest BETWEEN 50 AND 75 then '3rd quartile'

WHEN percentage\_forest BETWEEN 25 AND 50 then '2nd quartile'

ELSE '1st quartile'

END AS quartile

FROM sub)

SELECT Count(\*),

quartile

FROM sub\_quartiles

GROUP BY 2

ORDER BY 1 DESC

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

TOP Quartiles

WITH sub AS

(SELECT country,

region,

percentage\_forest

FROM forestation

WHERE year='2016' AND f\_area\_sqkm IS NOT NULL AND NOT country ='World'),

sub\_quartiles AS

(SELECT country,

region,

percentage\_forest,

CASE

WHEN percentage\_forest>=75 then '4th quartile'

WHEN percentage\_forest BETWEEN 50 AND 75 then '3rd quartile'

WHEN percentage\_forest BETWEEN 25 AND 50 then '2nd quartile'

ELSE '1st quartile'

END AS quartile

FROM sub)

SELECT country,

region,

ROUND(CAST(percentage\_forest AS NUMERIC),2),

quartile

FROM sub\_quartiles

WHERE quartile = '4th quartile'

ORDER BY 3 DESC

Additional question

3e) How many countries had a percent forestation higher than the United States in 2016?

WITH sub AS

(SELECT country,

region,

percentage\_forest

FROM forestation

WHERE year='2016' AND f\_area\_sqkm is NOT NULL AND NOT country ='World'),

sub\_quartiles AS

(SELECT country,

region,

percentage\_forest,

CASE

WHEN percentage\_forest>=75 then '4th quartile'

WHEN percentage\_forest BETWEEN 50 AND 75 then '3rd quartile'

WHEN percentage\_forest BETWEEN 25 AND 50 then '2nd quartile'

ELSE '1st quartile'

END AS quartile

FROM sub)

SELECT country,

region,

ROUND(CAST(percentage\_forest AS NUMERIC),2) as Percent\_forest,

quartile

FROM sub\_quartiles

WHERE country='United States'

Result of 33.93 be used to determine the countries

WITH sub AS

(SELECT country,

region,

percentage\_forest

FROM forestation

WHERE year='2016' AND f\_area\_sqkm is NOT NULL AND NOT country ='World'),

sub\_quartiles AS

(SELECT country,

region,

percentage\_forest,

CASE

WHEN percentage\_forest>=75 then '4th quartile'

WHEN percentage\_forest BETWEEN 50 AND 75 then '3rd quartile'

WHEN percentage\_forest BETWEEN 25 AND 50 then '2nd quartile'

ELSE '1st quartile'

END AS quartile

FROM sub)

SELECT Count(\*)

FROM sub\_quartiles

WHERE percentage\_forest>33.93