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 41282694.90 sqkm in 1990. As of 2016, the most recent year for which data was available, that number had fallen to39958245.9sqkm, a loss of 1324449, or 3.208 %.

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 1279999.9891sqkm).

## 2. **REGIONAL OUTLOOK**

In 2016, the percentage 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 |
| Europe & Central Asia | 37.28 | 38.04 |
| North America | 35.65 | 36.04 |
| World | 32.42 | 31.38 |
| Sub-Saharan Africa | 30.67 | 28.79 |
| 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 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 527229.06sqkm. 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 79200.00sqkm, 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 | 5168.00 | 75.45 |
| Nigeria | 106506.00 | 61.80 |
| Uganda | 28092.00 | 59.13 |
| Mauritania | 1940.00 | 46.75 |
| Honduras | 36640.00 | 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 |
| First | 85 |
| Second | 73 |
| Third | 38 |
| Fourth | 9 |

The largest number of countries in 2016 were found in the first quartile.

There were 94 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?*

*Deforestation has been gradually happening. It’s a real threat. The analysis showed a reduction of the global forest of 3.208% from 1990 to 2016. One of the most impacted regions is Sub-Sara Africa. For example, when we look at* 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 Sub-Saharan Africa. This is followed by Latin America & Caribbean. These regions are developing countries and maybe they may not be aware of the danger of deforestation. Poverty is also prevalent in these regions, so we can say that the poorest regions of the world are experiencing higher deforestation than other regions.

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

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 needs to step up remedial efforts. Other countries that we should focus are Togo, Uganda, Brazil. The recommendation is that we should create awareness in this region educating them on the danger of deforestation. They need to understand that their way of life is having an ecological impact in their area.

## 5. APPENDIX: SQL Queries Used

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

CREATE VIEW forestation AS

SELECT

f.country\_code,

f.country\_name,

f.year,

f.forest\_area\_sqkm,

l.total\_area\_sq\_mi,

r.region,

r.income\_group,

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

f.forest\_area\_sqkm / (l.total\_area\_sq\_mi \* 2.59) \* 100 AS percent\_of\_land\_area\_that\_is\_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;

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.”

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

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

WITH sub AS (

SELECT year, country\_name, region, forest\_area\_sqkm

FROM forestation

WHERE country\_name = 'World' AND (year = 2016 OR year = 1990)

)

SELECT

s1.region,

s1.forest\_area\_sqkm AS forest\_area\_sqkm\_2016,

s2.forest\_area\_sqkm AS forest\_area\_sqkm\_1990,

s2.forest\_area\_sqkm - s1.forest\_area\_sqkm AS drop\_in\_forest\_area,

(s2.forest\_area\_sqkm - s1.forest\_area\_sqkm) \* 100 / s2.forest\_area\_sqkm AS percentage\_drop\_in\_forest\_area

FROM

sub s1

JOIN

sub s2

ON

s1.region = s2.region AND s1.year > s2.year;

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 sub AS (

SELECT year, country\_name, region, forest\_area\_sqkm

FROM forestation

WHERE country\_name = 'World' AND (year = 2016 OR year = 1990)

),

sub2 AS (

SELECT

s1.region,

s1.forest\_area\_sqkm AS forest\_area\_sqkm\_2016,

s2.forest\_area\_sqkm AS forest\_area\_sqkm\_1990,

s2.forest\_area\_sqkm - s1.forest\_area\_sqkm AS drop\_in\_forest\_area,

(s2.forest\_area\_sqkm - s1.forest\_area\_sqkm) \* 100 / s2.forest\_area\_sqkm AS percentage\_drop\_in\_forest\_area

FROM

sub s1

JOIN

sub s2

ON

s1.region = s2.region AND s1.year > s2.year

)

SELECT

year,

country\_name,

total\_area\_sqkm,

ABS(total\_area\_sqkm - (SELECT drop\_in\_forest\_area FROM sub2)) AS absolute\_diff

FROM

forestation

WHERE

year = 2016

ORDER BY

absolute\_diff

LIMIT 1;

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).

Based on the table you created:

SELECT

region,

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

SUM(total\_area\_sqkm) AS total\_area\_sqkm,

ROUND(

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

2

) AS percent\_forest\_area

FROM

forestation

WHERE

year = 2016

GROUP BY

region

ORDER BY

percent\_forest\_area DESC;

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,

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

SUM(total\_area\_sqkm) AS total\_area\_sqkm,

ROUND(

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

2

) AS percent\_forest\_area

FROM

forestation

WHERE

year = 2016 AND region = 'World'

GROUP BY

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,

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

SUM(total\_area\_sqkm) AS total\_area\_sqkm,

ROUND(

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

2

) AS percent\_forest\_area

FROM

forestation

WHERE

year = 1990 AND region = 'World'

GROUP BY

region

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

WITH sub AS (

SELECT

year,

region,

forest\_area\_sqkm,

total\_area\_sqkm

FROM

forestation

WHERE

year = 2016 OR year = 1990

),

sub2 AS (

SELECT

s1.region,

s1.forest\_area\_sqkm AS forest\_area\_sqkm\_2016,

s1.total\_area\_sqkm AS total\_area\_sqkm\_2016,

s2.forest\_area\_sqkm AS forest\_area\_sqkm\_1990,

s2.total\_area\_sqkm AS total\_area\_sqkm\_1990

FROM

sub s1

JOIN

sub s2 ON s1.region = s2.region AND s1.year > s2.year

)

SELECT

region,

ROUND(

CAST(SUM(forest\_area\_sqkm\_1990) \* 100 / SUM(total\_area\_sqkm\_1990) AS NUMERIC),

2

) AS perc\_forest\_area\_1990,

ROUND(

CAST(SUM(forest\_area\_sqkm\_2016) \* 100 / SUM(total\_area\_sqkm\_2016) AS NUMERIC),

2

) AS perc\_forest\_area\_2016

FROM

sub2

GROUP BY

region

ORDER BY

perc\_forest\_area\_1990 DESC;

Part 3 - Country-Level Detail

**Success Stories**

WITH sub AS (

SELECT

year,

country\_name,

region,

forest\_area\_sqkm

FROM

forestation

WHERE

(year = 2016 OR year = 1990) AND

region != 'World' AND

forest\_area\_sqkm IS NOT NULL

)

SELECT

s1.country\_name,

s1.forest\_area\_sqkm AS forest\_area\_sqkm\_2016,

s2.forest\_area\_sqkm AS forest\_area\_sqkm\_1990,

ROUND(CAST((s1.forest\_area\_sqkm - s2.forest\_area\_sqkm) AS NUMERIC), 2) AS increase\_in\_forest\_area,

ROUND(CAST(100 \* ((s1.forest\_area\_sqkm - s2.forest\_area\_sqkm) / s2.forest\_area\_sqkm) AS NUMERIC), 2) AS perc\_change\_in\_forest\_area

FROM

sub s1

JOIN

sub s2 ON s1.country\_name = s2.country\_name AND s1.year > s2.year

ORDER BY

increase\_in\_forest\_area DESC;

WITH sub AS (

SELECT

year,

country\_name,

region,

forest\_area\_sqkm

FROM

forestation

WHERE

(year = 2016 OR year = 1990) AND

region != 'World' AND

forest\_area\_sqkm IS NOT NULL

)

SELECT

s1.country\_name,

s1.forest\_area\_sqkm AS forest\_area\_sqkm\_2016,

s2.forest\_area\_sqkm AS forest\_area\_sqkm\_1990,

ROUND(CAST((s1.forest\_area\_sqkm - s2.forest\_area\_sqkm) AS NUMERIC), 2) AS increase\_in\_forest\_area,

ROUND(CAST(100 \* ((s1.forest\_area\_sqkm - s2.forest\_area\_sqkm) / s2.forest\_area\_sqkm) AS NUMERIC), 2) AS perc\_change\_in\_forest\_area

FROM

sub s1

JOIN

sub s2 ON s1.country\_name = s2.country\_name AND s1.year > s2.year

ORDER BY

perc\_change\_in\_forest\_area DESC;

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 sub AS (

SELECT

year,

country\_name,

region,

forest\_area\_sqkm

FROM

forestation

WHERE

(year = 2016 OR year = 1990) AND

region != 'World' AND

forest\_area\_sqkm IS NOT NULL

)

SELECT

s1.country\_name,

s1.region,

ROUND(CAST((s2.forest\_area\_sqkm - s1.forest\_area\_sqkm) AS NUMERIC), 2) AS change\_in\_forest\_area

FROM

sub s1

JOIN

sub s2 ON s1.country\_name = s2.country\_name AND s1.year > s2.year

ORDER BY

change\_in\_forest\_area 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?

WITH sub AS (

SELECT

year,

country\_name,

region,

forest\_area\_sqkm

FROM

forestation

WHERE

(year = 2016 OR year = 1990) AND

region != 'World' AND

forest\_area\_sqkm IS NOT NULL

)

SELECT

s1.country\_name,

s1.region,

ROUND(CAST((s2.forest\_area\_sqkm - s1.forest\_area\_sqkm) AS NUMERIC), 2) AS change\_in\_forest\_area,

ROUND(CAST(100 \* ((s2.forest\_area\_sqkm - s1.forest\_area\_sqkm) / s2.forest\_area\_sqkm) AS NUMERIC), 2) AS per\_change\_in\_forest\_area

FROM

sub s1

JOIN

sub s2 ON s1.country\_name = s2.country\_name AND s1.year > s2.year

ORDER BY

per\_change\_in\_forest\_area DESC

LIMIT 5;

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

WITH sub AS (

SELECT

year,

country\_name,

region,

forest\_area\_sqkm \* 100 / total\_area\_sqkm AS percent\_forestation

FROM

forestation

WHERE

year = 2016

),

sub2 AS (

SELECT

country\_name,

CASE

WHEN percent\_forestation > 75 THEN 'Fourth'

WHEN percent\_forestation > 50 THEN 'Third'

WHEN percent\_forestation > 25 THEN 'Second'

ELSE 'First'

END AS quartile\_category

FROM

sub

WHERE

percent\_forestation IS NOT NULL

)

SELECT

DISTINCT quartile\_category,

COUNT(country\_name) OVER(PARTITION BY quartile\_category) AS number\_of\_countries

FROM

sub2

ORDER BY

number\_of\_countries DESC;

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

WITH sub AS (

SELECT

year,

country\_name,

region,

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

FROM

forestation

WHERE

year = 2016

),

sub2 AS (

SELECT

country\_name,

region,

percent\_forestation,

CASE

WHEN percent\_forestation > 75 THEN 'Fourth'

WHEN percent\_forestation > 50 THEN 'Third'

WHEN percent\_forestation > 25 THEN 'Second'

ELSE 'First'

END AS quartile\_category

FROM

sub

WHERE

percent\_forestation IS NOT NULL

)

SELECT

country\_name,

region,

percent\_forestation

FROM

sub2

WHERE

quartile\_category = 'Fourth'

ORDER BY

percent\_forestation DESC;

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

WITH sub AS (

SELECT

year,

country\_name,

region,

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

FROM

forestation

WHERE

year = 2016

),

sub2 AS (

SELECT

country\_name,

percent\_forestation,

CASE

WHEN percent\_forestation > 75 THEN 'Fourth'

WHEN percent\_forestation > 50 THEN 'Third'

WHEN percent\_forestation > 25 THEN 'Second'

ELSE 'First'

END AS quartile\_category

FROM

sub

WHERE

percent\_forestation IS NOT NULL

)

SELECT

COUNT(\*)

FROM

sub2

WHERE

percent\_forestation > (

SELECT

percent\_forestation

FROM

sub2

WHERE

country\_name = 'United States'

);