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 \_\_\_\_\_\_\_\_\_r 3.21%.\_\_\_\_\_\_\_\_\_%.

The forest area lost over this time period is slightly more than the entire land area of \_\_\_\_\_\_Mongolia\_\_\_\_\_\_\_\_\_\_\_\_ listed for the year 2016 (which is \_\_\_ 1553560 km2 )\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_).

## 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 |
| --- | --- | --- |
| East Asia & Pacific | 25.78 | 25.78 |
| Europe & Central Asia | 25.78 | 25.78 |
| Latin America & Caribbean | 25.78 | 25.78 |
| Middle East & North Africa | 25.78 | 25.78 |
| North America | 25.78 | 25.78 |
| South Asia | 25.78 | 25.78 |
| South Asia | 25.78 | 25.78 |

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 \_\_\_\_\_\_\_\_\_\_ 527229.06 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\_\_\_\_\_\_\_\_.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 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 \_\_\_\_\_313.66% \_\_\_\_\_\_\_\_\_\_\_\_ 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 | -282194 |
| Myanmar | East Asia & Pacific | -107234 |
| Nigeria | Sub-Saharan Africa | -106506 |
| 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 | -61.8 |
| 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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. 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 | 37 |
| Fourth | 9 |

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

There were \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 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?*

*Based on the analysis conducted by the World Bank, there are indications of a further decrease in the global forest area. Particular attention should be directed towards countries that have experienced the most significant percentage reduction in forest area. These countries include Togo, Nigeria, Uganda, Mauritania, and Honduras. Notably, four out of these five countries are situated in the Sub-Saharan Africa region and have low to lower middle income levels. It is imperative to investigate the underlying causes behind the decline in forest cover in these regions, whether it is related to the sourcing of exotic wood, agricultural activities, fires, or climate changes.*

*On the other hand, China serves as a positive example, having increased its forest area. This case should be thoroughly examined, and recommendations can be drawn to aid low-income countries in their efforts to address similar challenges. Understanding the factors contributing to deforestation and implementing sustainable practices is crucial for preserving forest ecosystems worldwide.*

## 5. APPENDIX: SQL Queries Used

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

CREATE VIEW forestation AS

SELECT fa.country\_code,

fa.country\_name,

r.region,

r.income\_group,

fa.year,

fa.forest\_area\_sqkm,

-- convert land area to square kilimeters

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

-- compute the percent of forest area

(

fa.forest\_area\_sqkm / (la.total\_area\_sq\_mi \* 2.59)

) \* 100 AS forest\_percent

FROM forest\_area AS fa -- join land and forest tables

JOIN land\_area AS la ON fa.country\_code = la.country\_code

AND fa.year = la.year -- join region to forest table

JOIN regions AS r ON fa.country\_code = r.country\_code

ORDER BY country\_code,

year;

-- PART 1

-- GLOBAL SITUATION

-- Q1

/\* 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 ROUND(forest\_area\_sqkm) AS forest\_area\_sqkm\_1990

FROM forestation

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

-- Q3

/\* What was the change (in sq km) in the forest area of the world from 1990 to

2016? \*/

WITH table1 AS(

SELECT forest\_area\_sqkm AS forest\_area\_sqkm\_1990

FROM forestation

WHERE year = 1990

AND country\_name = 'World'

),

table2 AS(

SELECT forest\_area\_sqkm AS forest\_area\_sqkm\_2016

FROM forestation

WHERE year = 2016

AND country\_name = 'World'

)

SELECT ROUND(table1.forest\_area\_sqkm\_1990 - table2.forest\_area\_sqkm\_2016) AS

forest\_area\_change

FROM table1,

table2;

-- Q4

/\* What was the percent change in forest area of the world between 1990 and 2016?

\*/

WITH table1 AS(

SELECT forest\_area\_sqkm AS forest\_area\_sqkm\_1990

FROM forestation

WHERE year = 1990

AND country\_name = 'World'

),

table2 AS(

SELECT forest\_area\_sqkm AS forest\_area\_sqkm\_2016

FROM forestation

WHERE year = 2016

AND country\_name = 'World'

)

SELECT ROUND(

(

(

-(

table1.forest\_area\_sqkm\_1990 - table2.forest\_area\_sqkm\_2016

) / table1.forest\_area\_sqkm\_1990

) \* 100

)::NUMERIC,

2

)::VARCHAR || '%' AS forest\_area\_change

FROM table1,

table2;

-- Q5

/\* 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 DISTINCT country\_name,

ROUND(total\_area\_sqkm::NUMERIC) AS total\_area\_sqkm

FROM forestation

WHERE total\_area\_sqkm >= (

WITH table1 AS(

SELECT forest\_area\_sqkm AS forest\_area\_sqkm\_1990

FROM forestation

WHERE year = 1990

AND country\_name = 'World'

),

table2 AS(

SELECT forest\_area\_sqkm AS forest\_area\_sqkm\_2016

FROM forestation

WHERE year = 2016

AND country\_name = 'World'

)

SELECT table1.forest\_area\_sqkm\_1990 - table2.forest\_area\_sqkm\_2016 AS

forest\_area\_change

FROM table1,

table2

)

ORDER BY total\_area\_sqkm

LIMIT 1;

-- PART 2

-- REGIONAL OUTLOOK

-- Q1

/\* 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 sub.\*,

ROUND(

((sub.forest\_area / sub.land\_area) \* 100)::NUMERIC,

2

) AS forest\_percent

FROM(SELECT region,

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

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

FROM forestation

GROUP BY region,

year

HAVING year = 2016) AS sub

ORDER BY region;

-- Q2

/\* 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 sub.\*,

ROUND(

((sub.forest\_area / sub.land\_area) \* 100)::NUMERIC,

2

) AS forest\_percent

FROM(

SELECT region,

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

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

FROM forestation

GROUP BY region,

year

HAVING year = 1990

) AS sub

ORDER BY region;

-- Q3

/\* Based on the table you created,

which regions of the world DECREASED in forest area from 1990 to 2016? \*/

WITH t1 AS (

SELECT sub.\*,

ROUND(

((sub.forest\_area / sub.land\_area) \* 100)::NUMERIC,

2

) AS forest\_percent

FROM(

SELECT region,

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

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

FROM forestation

GROUP BY region,

year

HAVING year = 2016

) AS sub

ORDER BY forest\_percent

),

t2 AS (

SELECT sub.\*,

ROUND(

((sub.forest\_area / sub.land\_area) \* 100)::NUMERIC,

2

) AS forest\_percent

FROM(

SELECT region,

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

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

FROM forestation

GROUP BY region,

year

HAVING year = 1990

) AS sub

ORDER BY forest\_percent

)

SELECT t1.region,

t1.forest\_percent - t2.forest\_percent AS change\_prc

FROM t1

JOIN t2 ON t1.region = t2.region

AND t1.forest\_percent < t2.forest\_percent

ORDER BY change\_prc;

-- PART 3

-- COUNTRY-LEVEL DETAIL

-- Q1

/\* 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\_code,

country\_name,

region,

forest\_area\_sqkm

FROM forestation

WHERE year = 1990

),

t2 AS (

SELECT country\_code,

country\_name,

forest\_area\_sqkm

FROM forestation

WHERE year = 2016

)

SELECT t1.country\_name,

t1.region,

t1.forest\_area\_sqkm AS forest\_area\_1990,

t2.forest\_area\_sqkm AS forest\_area\_2016,

ROUND(

(t2.forest\_area\_sqkm - t1.forest\_area\_sqkm)::NUMERIC,

2

) AS change

FROM t1

JOIN t2 ON t1.country\_code = t2.country\_code

WHERE t1.country\_name NOT LIKE 'World'

ORDER BY change

LIMIT 5;

-- Q2

/\* 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 t1 AS (

SELECT country\_code,

country\_name,

region,

forest\_area\_sqkm

FROM forestation

WHERE year = 1990

),

t2 AS (

SELECT country\_code,

country\_name,

forest\_area\_sqkm

FROM forestation

WHERE year = 2016

)

SELECT t1.country\_name,

t1.region,

t1.forest\_area\_sqkm AS forest\_area\_1990,

t2.forest\_area\_sqkm AS forest\_area\_2016,

ROUND(

-((1 -(t2.forest\_area\_sqkm / t1.forest\_area\_sqkm)) \* 100)::NUMERIC, 2) AS

change\_prc

FROM t1

JOIN t2 ON t1.country\_code = t2.country\_code

AND t2.forest\_area\_sqkm < t1.forest\_area\_sqkm

WHERE t1.country\_name NOT LIKE 'World'

ORDER BY change\_prc

LIMIT 5;

-- Q3

/\* If countries were grouped by percent forestation in quartiles,

which group had the most countries in it in 2016? \*/

WITH sub AS (

SELECT country\_name,

CASE

WHEN forest\_percent < 25 THEN '0-25%'

WHEN forest\_percent >= 25

AND forest\_percent < 50 THEN '25-50%'

WHEN forest\_percent >= 50

AND forest\_percent < 75 THEN '50-75%'

ELSE '75-100%'

END AS quartile

FROM forestation

WHERE year = 2016

AND forest\_percent IS NOT NULL

)

SELECT DISTINCT quartile,

(COUNT(country\_name) OVER (PARTITION BY quartile)) AS count

FROM sub

ORDER BY quartile;

-- Q4

/\* List all of the countries that were in the 4th quartile (percent forest > 75%)

in 2016. \*/

WITH sub AS (

SELECT country\_name,

CASE

WHEN forest\_percent < 25 THEN '0-25%'

WHEN forest\_percent >= 25

AND forest\_percent < 50 THEN '25-50%'

WHEN forest\_percent >= 50

AND forest\_percent < 75 THEN '50-75%'

ELSE '75-100%'

END AS quartile

FROM forestation

WHERE year = 2016

AND forest\_percent IS NOT NULL

)

SELECT country\_name,

quartile

FROM sub

WHERE quartile = '75-100%';

-- Q5

/\* How many countries had a percent forestation higher than the United States in

2016? \*/

SELECT COUNT(\*) AS count

FROM(

SELECT DISTINCT country\_name

FROM forestation

WHERE forest\_percent > (

SELECT forest\_percent

FROM forestation

WHERE (country\_name = 'United States')

AND year = 2016

)

ORDER BY country\_name

) AS sub;