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 **41282696 sqkm** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958246 sqkm,** a loss of **1324449 sqkm**, or **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 sqkm).

## 2. **REGIONAL OUTLOOK**

In 2016, the percent of the total land area of the world designated as forest was **31.34%.** The region with the highest relative forestation was **Latin America,** 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 **32.38%.** 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 | 26.36 |
| Europe & Central Asia | 37.28 | 38.04 |
| Latin America & North Africa | 51.03 | 46.16 |
| Middle East & North Africa | 1.78 | 2.07 |
| North America | 35.65 | 36.04 |
| South Asia | 16.51 | 17.51 |
| Sub-Saharan Africa | 30.67 | 28.79 |

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 sqkm.** 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 sqkm,** 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 | -541510.00 |
| Indonesia | East Asia & Pacific | -282194.00 |
| Myanmar | East Asia & Pacific | -107234.00 |
| Nigeria | Sun-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 | 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.** 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 | 85 |
| 2nd | 73 |
| 3rd | 38 |
| 4th | 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 |
| Micronesia, Fed. Sts. | East Asia & Pacific | 91.86 |
| Lao PDR | East Asia & Pacific | 82.11 |
| 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 |
| Suriname | Latin America & Caribbean | 98.26 |
| Solomon Islands | East Asia & Pacific | 77.86 |
| Gabon | Sub-Saharan Africa | 90.04 |

## 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 World Bank's analysis indicates that global forest area continues to shrink, highlighting the need for heightened attention. Countries with the most significant percentage reduction in forest coverage, including Nigeria, Togo, Mauritania, Uganda, and Honduras, require particular focus.*

*The analysis reveals a gradual disappearance of forests worldwide, with data showing a decline in global forest area between 1990 and 2016. Sub-Saharan Africa emerges as the most impacted region, exemplified by Togo's substantial 75.45% reduction in forest coverage. Additionally, when examining the distribution of countries based on their forestation percentages, we observe that 85 countries fall within the first quartile, having forestation levels ranging from 0% to 25%, while the second quartile comprises 72 countries with forestation levels between 25% and 50%.*

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

*Four out of five of these countries are situated in the Sub-Saharan Africa region, all of which have low to lower-middle-income status. It is crucial to investigate the factors contributing to the decline in forest cover within these regions, such as the sourcing of exotic wood, agricultural practices, fires, and climate changes. An instructive example of a country that has managed to increase its forest area is China, and studying their case could provide valuable insights and recommendations for low-income countries.*

*Among the countries with the highest percentage decrease in forest cover, four out of five are located in Sub-Saharan Africa. Togo, for instance, experienced a significant loss of over 75% of its forest during the analyzed period from 1990 to 2016. Other countries that demand our attention include Nigeria (61.80% reduction), Uganda (59.13% reduction), and Mauritania (46.75% reduction). It is crucial for people to recognize that our way of life often results in an unsustainable ecological footprint.*

*To mitigate this issue, there are several steps that can be taken. Firstly, reducing personal consumption can help slow down the trend of deforestation, as decreased production of goods can have a positive impact. Secondly, it is important to avoid products containing palm oil, as its production contributes significantly to deforestation, particularly in Asia. Lastly, opting for sustainably certified products while shopping can contribute to minimizing ecological damage.*

## 5. APPENDIX: SQL Queries Used

-- Creating forestation view

CREATE VIEW forestation

AS

SELECT fore\_a.country\_name,

reg.region,

fore\_a.country\_code,

reg.income\_group,

fore\_a.year,

fore\_a.forest\_area\_sqkm,

(land\_a.total\_area\_sq\_mi \* 2.59) AS total\_area\_sqkm,

(fore\_a.forest\_area\_sqkm / (land\_a.total\_area\_sq\_mi \* 2.59)) \* 100 AS forest\_percent

FROM forest\_area fore\_a

JOIN land\_area land\_a

ON fore\_a.country\_code = land\_a.country\_code

AND fore\_a.year = land\_a.year

JOIN regions reg

ON fore\_a.country\_code = reg.country\_code

-- GLOBAL SITUATION

-- Total forest area (in sq km) of the world in 1990

SELECT ROUND(forest\_area\_sqkm) forest\_area\_1990

FROM forestation

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

-- Total forest area (in sq km) of the world in 2016

SELECT ROUND(forest\_area\_sqkm) AS forest\_area\_2016

FROM forestation

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

-- The change (in sq km) in the forest area of the world from 1990 to 2016

WITH total\_forest\_area\_2016 AS(

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

FROM forestation

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

),

total\_forest\_area\_1990 AS(

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

FROM forestation

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

)

SELECT

(total\_forest\_area\_2016.forest\_area\_sqkm\_2016 -

total\_forest\_area\_1990.forest\_area\_sqkm\_1990) AS forest\_area\_change

FROM

total\_forest\_area\_1990,

total\_forest\_area\_2016;

-- The change (in sq km) in the forest area of the world from 1990 to 2016

WITH total\_area\_2016 AS(

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

FROM forestation

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

),

total\_area\_1990 AS(

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

FROM forestation

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

)

SELECT

ROUND((

(total\_area\_2016.forest\_area\_sqkm\_2016 -

total\_area\_1990.forest\_area\_sqkm\_1990)/

(

total\_area\_1990.forest\_area\_sqkm\_1990)\*100

)::NUMERIC,2) AS forest\_percentage\_change

FROM

total\_area\_1990,

total\_area\_2016;

-- The amount of forest area lost between 1990 and 2016

-- Country's total area in 2016 is it closest to

SELECT country\_name, total\_area\_sqkm

FROM forestation

WHERE total\_area\_sqkm >=(

WITH total\_area\_2016 AS(

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

FROM forestation

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

),

total\_area\_1990 AS(

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

FROM forestation

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

)

SELECT

-(total\_area\_2016.forest\_area\_sqkm\_2016 -

total\_area\_1990.forest\_area\_sqkm\_1990) AS forest\_lost

FROM

total\_area\_1990,

total\_area\_2016

)

ORDER BY total\_area\_sqkm

LIMIT 1;

-- REGIONAL OUTLOOK

-- Percent forest of the entire world in 2016

SELECT Round(( ( SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) ) \* 100 ) ::

NUMERIC, 2)

FROM forestation

WHERE year = 2016;

-- Region had the HIGHEST percent forest in 2016

SELECT region,

forest\_area,

Round(( ( forest\_area / 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 total

ORDER BY forest\_percent DESC

LIMIT 1;

-- and which had the LOWEST, to 2 decimal places

SELECT region,

forest\_area,

Round(( ( forest\_area / 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 total

ORDER BY forest\_percent DESC

LIMIT 1;

-- The percent forest of the entire world in 1990

SELECT Round(( ( SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) ) \* 100 ) ::

NUMERIC, 2)

FROM forestation

WHERE year = 1990 ;

-- Region had the HIGHEST percent forest in 1990

SELECT region,

forest\_area,

Round(( ( forest\_area / 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 total

ORDER BY forest\_percent DESC

LIMIT 1;

-- And which had the LOWEST, to 2 decimal places

SELECT region,

forest\_area,

ROUND(( ( forest\_area / 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 total

ORDER BY forest\_percent ASC

LIMIT 1;

-- Regions of the world DECREASED in forest area from 1990 to 2016

WITH table\_1

AS (SELECT region,

forest\_area,

ROUND(( ( forest\_area / 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 total

ORDER BY forest\_percent),

table\_2

AS (SELECT region,

forest\_area,

ROUND(( ( forest\_area / 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 total

ORDER BY forest\_percent)

SELECT TABLE\_1.region,

TABLE\_2.forest\_percent - TABLE\_1.forest\_percent AS

forest\_percentage\_change

FROM table\_1

join table\_2

ON TABLE\_1.region = TABLE\_2.region

AND TABLE\_1.forest\_percent < TABLE\_2.forest\_percent

ORDER BY forest\_percentage\_change;

-- COUNTRY-LEVEL DETAIL

-- 5 countries saw the largest amount decrease in forest area from 1990 to 2016

-- The difference in forest area for each

WITH table\_1 AS

(

SELECT region,

country\_name,

forest\_area\_sqkm

FROM forestation

WHERE year = 1990 ),

table\_2 AS

(

SELECT region,

country\_name,

forest\_area\_sqkm

FROM forestation

WHERE year = 2016 )

SELECT table\_1.region,

table\_1.country\_name,

table\_1.forest\_area\_sqkm AS forest\_1990,

table\_2.forest\_area\_sqkm AS forest\_2016,

Round( Cast( ( table\_1.forest\_area\_sqkm - table\_2.forest\_area\_sqkm ) AS NUMERIC ), 2 ) AS forest\_change

FROM table\_1

JOIN table\_2

ON table\_1.country\_name = table\_2.country\_name

WHERE table\_2.forest\_area\_sqkm < table\_1.forest\_area\_sqkm

AND table\_1.region NOT LIKE 'World'

ORDER BY forest\_change DESC LIMIT 5;

-- 5 countries saw the largest percent decrease in forest area from 1990 to 2016

-- The percent change to 2 decimal places for each

WITH table\_1 AS

(

SELECT region,

country\_name,

forest\_area\_sqkm

FROM forestation

WHERE year = 1990 ), table\_2 AS

(

SELECT region,

country\_name,

forest\_area\_sqkm

FROM forestation

WHERE year = 2016 )

SELECT table\_1.region,

table\_1.country\_name,

table\_1.forest\_area\_sqkm AS forest\_area\_1990,

table\_2.forest\_area\_sqkm AS forest\_area\_2016,

Round( Cast( ( table\_1.forest\_area\_sqkm - table\_2.forest\_area\_sqkm ) AS NUMERIC ), 2 ) AS difference,

Round( Cast( ( ( table\_1.forest\_area\_sqkm - table\_2.forest\_area\_sqkm )\* 100 / table\_1.forest\_area\_sqkm ) AS NUMERIC ), 2 ) AS percentage\_decrease

FROM table\_1

JOIN table\_2

ON table\_1.country\_name = table\_2.country\_name

WHERE table\_2.forest\_area\_sqkm < table\_1.forest\_area\_sqkm

ORDER BY percentage\_decrease DESC LIMIT 5;

-- countries grouped by percent forestation in quartiles

-- Group with the most countries in it in 2016

WITH country\_forest\_perc

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 country\_forest\_perc

ORDER BY quartile;

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

WITH fourth\_quartile\_country

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 fourth\_quartile\_country

WHERE quartile = '75-100%';

-- Number of 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 number\_of\_countries;