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

## 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 |
| --- | --- | --- |
| Middle East & North Africa | 1.78 | 2.07 |
| South Asia | 16.51 | 17.51 |
| East Asia & Pacific | 25.78 | 26.36 |
| Sub-Saharan Africa | 30.67 | 28.79 |
| North America | 35.65 | 36.04 |
| Europe & Central Asia | 37.28 | 38.04 |
| Latin America & Caribbean | 51.03 | 46.16 |
| World | 32.42 | 31.38 |

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 527229.06. 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 79200.00, much lower than the figure for China.

China and the 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: Brazil, Indonesia, Myanmar

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 | Sub-Saharan Africa | 75.45 |
| Nigeria | Sub-Saharan Africa | 61.80 |
| Uganda | Sub-Saharan Africa | 59.27 |
| 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 ofSub-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 |
| --- | --- |
| 0-25% | 85 |
| 25-50% | 73 |
| 50-75% | 38 |
| 75-100% | 9 |

The largest number of countries in 2016 were found in the first 0-25% 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?*

*I learned from the World Bank data, that the total forest area in the world decreased from 41,282,694.9 sq. km in 1990 to 39,958,245.9 sq. km in 2016 which is a loss of 3.2%. Even though China and the United States are 2 countries whose forest area increased from 1990 to 2016, the only regions of the world that decreased in percent forest area were Latin America & Caribbean and Sub-Saharan Africa. In comparison to Iceland, with a smaller sq. km, their forest area increased between 1990 and 2016.*

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

*I would focus on the countries with the largest absolute forest area change, which are Brazil, Indonesia, Myanmar, Nigeria, and Tanzania. While looking at countries that have high percentage forestation decrease is useful, maybe focusing on the countries that are reducing the most forest by land area is most important. For example, China can help us to find best practices for increasing forest area.*

Appendix:

**CREATE VIEW:**

CREATE VIEW forestation AS (

SELECT

f.country\_code AS country\_cd,

f.country\_name AS country\_nm,

f.year AS year,

f.forest\_area\_sqkm AS forest\_area\_sqkm,

l.total\_area\_sq\_mi AS total\_land\_sqmi,

r.region AS region,

r.income\_group AS income\_group,

(f.forest\_area\_sqkm \* 100) / (l.total\_area\_sq\_mi \* 2.59) AS forest\_percentage,

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

FROM

forest\_area AS f

JOIN land\_area AS l ON f.country\_code = l.country\_code

AND f.year = l.year

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

)

1. **GLOBAL SITUATION:**
2. ***What was the total forest area (in sq km) of the world in 1990?*** 41282694.9

SELECT

country\_nm,

forest\_area\_sqkm

FROM

forestation

WHERE

country\_nm = 'World'

AND year = '1990'

1. ***What was the total forest area (in sq km) of the world in 2016?*** 39958245.9

SELECT

country\_nm,

forest\_area\_sqkm

FROM

forestation

WHERE

country\_nm = 'World'

AND year = '2016'

1. **Difference between forest area from 1990 AND 2016** 1324449

SELECT

(

SELECT

forest\_area\_sqkm

FROM

forestation

WHERE

country\_nm = 'World'

AND year = '1990'

) - (

SELECT

forest\_area\_sqkm

FROM

forestation

WHERE

country\_nm = 'World'

AND year = '2016'

) AS change\_between\_years

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

SELECT

(

(

(

SELECT

forest\_area\_sqkm

FROM

forestation

WHERE

country\_nm = 'World'

AND year = '1990'

) - (

SELECT

forest\_area\_sqkm

FROM

forestation

WHERE

country\_nm = 'World'

AND year = '2016'

)

) / (

SELECT

forest\_area\_sqkm

FROM

forestation

WHERE

country\_nm = 'World'

AND year = '1990'

)

) \* 100

1. ***Country whose country land area is slightly less than forest area of world*** 3.21%

SELECT

country\_nm,

total\_area\_sqkm AS forest\_area\_lost

FROM

forestation

WHERE

year = 2016

AND total\_area\_sqkm <= 1324449

ORDER BY

2 DESC

LIMIT

1

1. **REGIONAL OUTLOOK**
2. ***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?***

***ENTIRE WORLD 2016:*** 31.38

SELECT

ROUND(forest\_percentage :: numeric, 2) AS forest\_percentage

FROM

forestation

WHERE

year = 2016

AND country\_nm = 'World'

***HIGHEST PERCENT: Latin America & Caribbean 46.16***

SELECT

region,

ROUND(

(

(

SUM(forest\_area\_sqkm)/ SUM(total\_land\_sqmi \* 2.59)

) \* 100

) :: numeric,

2

) AS forest\_percentage

FROM

forestation

WHERE

year = 2016

GROUP BY

1

ORDER BY

2 DESC

LIMIT

1

***LOWEST PERCENT: Middle East & North Africa 2.07***

SELECT

region,

ROUND(

(

(

SUM(forest\_area\_sqkm)/ SUM(total\_land\_sqmi \* 2.59)

) \* 100

) :: numeric,

2

) AS forest\_percentage

FROM

forestation

WHERE

year = 2016

GROUP BY

1

ORDER BY

2

LIMIT

1

1. ***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?***

***ENTIRE WORLD 1990:*** 32.42

SELECT

ROUND(forest\_percentage :: numeric, 2) AS forest\_percentage

FROM

forestation

WHERE

year = 1990

AND country\_nm = 'World'

***HIGHEST: Latin America & Caribbean 51.03***

SELECT

region,

ROUND(

(

(

SUM(forest\_area\_sqkm)/ SUM(total\_land\_sqmi \* 2.59)

) \* 100

) :: numeric,

2

) AS forest\_percentage

FROM

forestation

WHERE

year = 1990

GROUP BY

1

ORDER BY

2 DESC

LIMIT

1

***LOWEST: Middle East & North Africa 1.78***

SELECT

region,

ROUND(

(

(

SUM(forest\_area\_sqkm)/ SUM(total\_land\_sqmi \* 2.59)

) \* 100

) :: numeric,

2

) AS forest\_percentage

FROM

forestation

WHERE

year = 1990

GROUP BY

1

ORDER BY

2

LIMIT

1

1. ***Based on the table you created, which regions of the world DECREASED in forest area from 1990 to 2016? TABLE 2.1***

WITH forest\_percentage\_1990 AS (

SELECT

region,

ROUND(

(

(

SUM(forest\_area\_sqkm)/ SUM(total\_land\_sqmi \* 2.59)

) \* 100

) :: numeric,

2

) AS forest\_percentage\_90

FROM

forestation

WHERE

year = 1990

GROUP BY

1

ORDER BY

2

),

forest\_percentage\_2016 AS (

SELECT

region,

ROUND(

(

(

SUM(forest\_area\_sqkm)/ SUM(total\_land\_sqmi \* 2.59)

) \* 100

) :: numeric,

2

) AS forest\_percentage\_16

FROM

forestation

WHERE

year = 2016

GROUP BY

1

ORDER BY

2 DESC

),

JOINED\_1990\_2016 AS (

SELECT

fp90.region,

fp90.forest\_percentage\_90,

fp16.forest\_percentage\_16

FROM

forest\_percentage\_1990 AS fp90

JOIN forest\_percentage\_2016 AS fp16 ON fp90.region = fp16.region

)

SELECT

\*

FROM

JOINED\_1990\_2016

1. **COUNTRY-LEVEL DETAIL**

**SUCCESS STORIES**

1. ***WITH subquery to create jounes tables showing forest area per country level: China, United States,***

WITH forest\_area\_1990 AS (

SELECT

country\_nm,

forest\_area\_sqkm,

year

FROM

forestation

WHERE

year = 1990

),

forest\_area\_2016 AS (

SELECT

country\_nm,

forest\_area\_sqkm,

year

FROM

forestation

WHERE

year = 2016

),

joined\_1990\_2016 AS (

SELECT

fa90.country\_nm,

fa90.forest\_area\_sqkm AS forest\_area\_sqkm\_90,

fa90.year AS year\_90,

fa16.forest\_area\_sqkm AS forest\_area\_sqkm\_16,

fa16.year AS year\_16

FROM

forest\_area\_1990 AS fa90

JOIN forest\_area\_2016 AS fa16 ON fa90.country\_nm = fa16.country\_nm

)

SELECT

country\_nm,

ROUND(

(

forest\_area\_sqkm\_16 - forest\_area\_sqkm\_90

):: numeric,

2

) AS area\_increase

FROM

joined\_1990\_2016

WHERE

forest\_area\_sqkm\_16 > forest\_area\_sqkm\_90

ORDER BY

2 DESC

1. ***Iceland increased in forest area by 213.66% from 1990 to 2016***

WITH fp\_1990 AS (

SELECT

country\_nm,

forest\_percentage AS forest\_area\_percent\_1990

FROM

forestation

WHERE

year = 1990

),

fp\_2016 AS (

SELECT

country\_nm,

forest\_percentage AS forest\_area\_percent\_2016

FROM

forestation

WHERE

year = 2016

),

joined\_1990\_2016 AS (

SELECT

fp90.country\_nm AS country\_name,

fp90.forest\_area\_percent\_1990 AS area\_per\_90,

fp16.forest\_area\_percent\_2016 AS area\_per\_16

FROM

fp\_1990 AS fp90

JOIN fp\_2016 AS fp16 ON fp90.country\_nm = fp16.country\_nm

)

SELECT

country\_name,

ROUND(

(

(area\_per\_16 - area\_per\_90) / area\_per\_90 \* 100

) :: numeric,

2

) AS highest\_percentage\_growth

FROM

joined\_1990\_2016

WHERE

area\_per\_16 > area\_per\_90

ORDER BY

2 DESC

LIMIT

1

**3. LARGEST CONCERNS**

1. ***The following 3 countries had the largest decrease in forest area over the time period under consideration: Brazil, Indonesia, Myanmar***

WITH forest\_area\_1990 AS (

SELECT

country\_nm,

region,

forest\_area\_sqkm,

year

FROM

forestation

WHERE

year = 1990

),

forest\_area\_2016 AS (

SELECT

country\_nm,

region,

forest\_area\_sqkm,

year

FROM

forestation

WHERE

year = 2016

),

joined\_1990\_2016 AS (

SELECT

fa90.country\_nm,

fa90.region,

fa90.forest\_area\_sqkm AS forest\_area\_sqkm\_90,

fa90.year AS year\_90,

fa16.forest\_area\_sqkm AS forest\_area\_sqkm\_16,

fa16.year AS year\_16

FROM

forest\_area\_1990 AS fa90

JOIN forest\_area\_2016 AS fa16 ON fa90.country\_nm = fa16.country\_nm

)

SELECT

country\_nm AS country\_name,

region,

(

ROUND(

ABS(

forest\_area\_sqkm\_90 - forest\_area\_sqkm\_16

):: numeric,

2

)

) AS abs\_value\_forest\_area

FROM

joined\_1990\_2016

WHERE

forest\_area\_sqkm\_16 < forest\_area\_sqkm\_90

ORDER BY

3 DESC

LIMIT

6

1. ***Table 3.2 - Percent Decrease in Forest Area by Country, 1990 & 2016:***

WITH fp\_1990 AS (

SELECT

country\_nm,

region,

forest\_percentage AS forest\_area\_percent\_1990

FROM

forestation

WHERE

year = 1990

),

fp\_2016 AS (

SELECT

country\_nm,

forest\_percentage AS forest\_area\_percent\_2016

FROM

forestation

WHERE

year = 2016

),

joined\_1990\_2016 AS (

SELECT

fp90.country\_nm AS country\_name,

fp90.region AS region,

fp90.forest\_area\_percent\_1990 AS area\_per\_90,

fp16.forest\_area\_percent\_2016 AS area\_per\_16

FROM

fp\_1990 AS fp90

JOIN fp\_2016 AS fp16 ON fp90.country\_nm = fp16.country\_nm

)

SELECT

country\_name,

region,

ROUND(

(

(area\_per\_90 - area\_per\_16) / area\_per\_90 \* 100

):: numeric,

2

) AS percentage\_forest\_area

FROM

joined\_1990\_2016

WHERE

area\_per\_90 > area\_per\_16

ORDER BY

3 DESC

LIMIT

5

**QUARTILES**

***Table 3.3 - Count of Countries Grouped by Forestation Percent Quartiles, 2016:***

SELECT

CASE WHEN forest\_percentage < 25 THEN '0-25%' WHEN forest\_percentage >= 25

AND forest\_percentage < 50 THEN '25-50%' WHEN forest\_percentage >= 50

AND forest\_percentage < 75 THEN '50-75%' WHEN forest\_percentage >= 75 THEN '75-100%' ELSE 'No data' END AS quartiles,

COUNT(country\_nm)

FROM

forestation

WHERE

year = '2016'

GROUP BY

1

***Table 3.4 - Top Quartile Countries, 2016:***

SELECT country\_nm

, region

, ROUND(forest\_percentage ::numeric, 2) AS forest\_area\_percentage

FROM forestation

WHERE year = 2016

AND forest\_percentage >= 75

AND forest\_percentage <100

ORDER BY 3 DESC