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 **412,826,94.9 sqkm** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **399,582,45.9 sqkm**, a loss of **132,444,9 sqkm**, 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 **127,999,9.9891 sqkm**).

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 percentage 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

A. 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 **527,229.062 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 **792,00 sqkm**, 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's** forest area by **213.66%** from 1990 to 2016.

B. 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	541,510 sqkm
Indonesia	East Asia & Pacific	282,193.984 sqkm
Myanmar	East Asia & Pacific	107,234.0039 sqkm
Nigeria	Sub-Saharan Africa	106,506 sqkm
Tanzania	Sub-Saharan Africa	102,320 sqkm

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 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.

C. QUARTILES

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

Quartile	Number of Countries
0%-25%	85
25%-50%	72
50%-75%	38
75%-100%	9

The largest number of countries in 2016 were found in the **Quartile 1(<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%

4. RECOMMENDATIONS

On a global scale, the forested areas have experienced a decline of 3.21%. The magnitude of forest loss during this period surpasses the entire land area of Peru. In both 2016 and 1990, Latin America & Caribbean exhibited the highest

relative forestation, while the Middle East & North America displayed the lowest relative forestation. Between 1990 and 2016, China and the United States witnessed an increase in their forested areas by 527,229.062 units, followed by a smaller increase of 79,200 units. Although both countries are larger in size, when considering the percentage change, Iceland, a relatively smaller country, observed a remarkable growth of 213% in its forested area. In 2016, the majority of countries fell within Quartile 1 (<25%) in terms of forest coverage, while there were 9 countries in Quartile 4, characterized by a substantial percentage of their land area designated as forest.

Notably, the countries that witnessed a decrease in forest area percentage were exclusively located in Sub-Saharan Africa. It is crucial to direct our attention towards Sub-Saharan African nations such as Togo, Nigeria, Uganda, and Mauritania, as well as countries in Latin America & Caribbean like Honduras

5. APPENDIX: SQL Queries Used

```
DROP VIEW IF EXISTS forestation;
CREATE VIEW forestation
AS
(SELECT r.country_name, f.year, r.income_group, r.region, l.total_area_sq_mi,
f.forest_area_sqkm, ( ( Sum(forest_area_sqkm) / Sum(total_area_sq_mi * 2.59) ) * 100 )
percentage_forest FROM forest_area f
INNER JOIN land_area l
ON f.country_code = l.country_code
AND f.year = l.year
INNER JOIN regions r
ON r.country_code = f.country_code
GROUP BY r.country_name,
f.year,
r.income_group,
r.region,
l.total_area_sq_mi,
f.forest_area_sqkm)
```

PART–1

1.a

```
SELECT Sum(forest_area_sqkm) FROM forestation
WHERE year = 1990 AND country_name = 'World'
```

1.b

```
SELECT Sum(forest_area_sqkm) FROM forestation
WHERE year = 2016 AND country_name = 'World'
```

1.c

```
SELECT f_16.forest_area_sqkm - f_90.forest_area_sqkm AS difference
FROM ( SELECT forest_area_sqkm FROM forestation
  WHERE year = 1990 AND country_name = 'World') f_90
INNER JOIN ( SELECT forest_area_sqkm FROM forestation
  WHERE year = 2016 AND country_name = 'World' ) f_16 ON 1=1;
```

1.d

```
WITH forest_area_1990
AS (SELECT forest_area_sqkm
FROM forestation
WHERE year = 1990
AND country_name = 'World'),
forest_area_2016
AS (SELECT forest_area_sqkm
FROM forestation
WHERE year = 2016
AND country_name = 'World')
SELECT f_16.forest_area_sqkm - f_90.forest_area_sqkm AS difference,
( f_16.forest_area_sqkm -
f_90.forest_area_sqkm ) * 100 / f_90.forest_area_sqkm
AS percent_difference
FROM forest_area_1990 f_90,
forest_area_2016 f_16
```

1.e

```
SELECT  country_name, (total_area_sq_mi*2.59) AS total_land_area,
ABS(1324449- (total_area_sq_mi*2.59)) AS absolute_difference,year
FROM forestation
WHERE year = 2016 ORDER BY absolute_difference
```

PART–2

2.a.1

```
SELECT Round(percentage_forest :: NUMERIC, 2),
country_name
FROM forestation f
WHERE year = 2016
AND country_name = 'World'
GROUP BY country_name,
f.percentage_forest
```

2.a.2

```
SELECT Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sq_mi * 2.59) ) * 100 ):: 
NUMERIC, 2)AS precent_forest,region
FROM forestation f
WHERE year = 2016
GROUP BY region
ORDER BY 1 DESC
```

2.a.3

```
SELECT Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sq_mi * 2.59) ) * 100 ):: 
NUMERIC, 2)AS precent_forest,region
FROM forestation f
WHERE year = 2016
GROUP BY region
ORDER BY 1
```

2.b.1

```
SELECT Round(percentage_forest :: NUMERIC, 2),
country_name
FROM forestation f
WHERE year = 1990
AND country_name = 'World'
GROUP BY country_name,
f.percentage_forest
```

2.b.2

```
SELECT Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sq_mi * 2.59) ) * 100 ):: NUMERIC, 2)AS precent_forest,region
FROM forestation f
WHERE year = 1990
GROUP BY region
ORDER BY 1 DESC
```

2.b.3

```
SELECT Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sq_mi * 2.59) ) * 100 ):: NUMERIC, 2)AS precent_forest,region
FROM forestation f
WHERE year = 1990
GROUP BY region
ORDER BY 1 DESC
```

PART–3

3.a

```
WITH table_1 AS (
SELECT Sum(forest_area_sqkm) forest_area_1990,
country_name ,
region
FROM forestation f
WHERE year=1990
AND country_name !='World'
GROUP BY f.country_name ,
f.region ), table_2 AS (
SELECT Sum(forest_area_sqkm) forest_area_2016,
country_name,
region
FROM forestation f
WHERE year=2016
AND country_name !='World'
GROUP BY f.country_name ,
f.region)
SELECT t1.country_name ,
t1.region,
(t1.forest_area_1990-t2.forest_area_2016) forest_difference
FROM table_1 AS t1
INNER JOIN table_2 AS t2
```

```
ON t1.country_name=t2.country_name
AND (
t1.forest_area_1990 IS NOT NULL
AND t2.forest_area_2016 IS NOT NULL )
ORDER BY forest_difference DESC limit 5
```

3.b

```
WITH table_1 AS
(
SELECT ( Sum(forest_area_sqkm) / Sum(total_area_sq_mi * 2.59) ) * 100 AS
precent_forest_1990,
country_name ,
region
FROM forestation f
WHERE year=1990
AND country_name !='World'
GROUP BY f.country_name ,
f.region ), table_2 AS
(
SELECT ( Sum(forest_area_sqkm) / Sum(total_area_sq_mi * 2.59) ) * 100 AS
precent_forest_2016 ,
country_name,
region
FROM forestation f
WHERE year=2016
AND country_name !='World'
GROUP BY f.country_name ,
f.region)
SELECT t1.country_name ,
t1.region,
Round ((((t1.precent_forest_1990-t2.precent_forest_2016
)/(t1.precent_forest_1990))*100)::numeric,2) AS forest_difference_percent
FROM table_1 AS t1
INNER JOIN table_2 AS t2
ON t1.country_name=t2.country_name
AND ( t1.precent_forest_1990 IS NOT NULL
AND t2.precent_forest_2016 IS NOT NULL )
ORDER BY forest_difference_percent DESC limit 5
```

3.c

```
WITH table_1
AS (SELECT country_name,
year,
```

```
( Sum(forest_area_sqkm) / Sum(total_area_sq_mi * 2.59) ) * 100
percent_forestation_2016
FROM forestation
WHERE year = 2016
GROUP BY country_name,
year),
table_2
AS (SELECT table_1.country_name,
table_1.percent_forestation_2016,
CASE
WHEN table_1.percent_forestation_2016 < 25 THEN '0-25'
WHEN table_1.percent_forestation_2016 >= 25
AND table_1.percent_forestation_2016 < 50 THEN '25-50'
WHEN table_1.percent_forestation_2016 >= 50
AND table_1.percent_forestation_2016 < 75 THEN '50-75'
ELSE '75-100'
END AS percentails
FROM table_1
WHERE percent_forestation_2016 IS NOT NULL
AND year = 2016)
SELECT table_2.percentails,
Count(table_2.percentails)
FROM table_2
GROUP BY 1
ORDER BY 2 DESC;
```

3.d

```
WITH table_1
AS (SELECT country_name,
year,
region,
( Sum(forest_area_sqkm) / Sum(total_area_sq_mi * 2.59) ) * 100
percent_forestation_2016
FROM forestation
WHERE year = 2016
GROUP BY country_name,
year, region), table_2 AS (SELECT table_1.country_name,
table_1.percent_forestation_2016,
table_1.region,
CASE
WHEN table_1.percent_forestation_2016 < 25 THEN '0-25'
WHEN table_1.percent_forestation_2016 >= 25
```

```
AND table_1.percent_forestation_2016 < 50 THEN '25-50'
WHEN table_1.percent_forestation_2016 >= 50
AND table_1.percent_forestation_2016 < 75 THEN '50-75'
ELSE '75-100'
END AS percentails
FROM table_1
WHERE percent_forestation_2016 IS NOT NULL
AND year = 2016)
SELECT table_2.country_name,
table_2.region,
Round(Cast(table_2.percent_forestation_2016 AS NUMERIC), 2) AS
percent_forestation_2016
FROM table_2
WHERE table_2.percentails = '75-100'
ORDER BY 3 DESC
```

3.e

```
WITH table_1
AS (SELECT country_name,
year,
( Sum(forest_area_sqkm) / Sum(total_area_sq_mi * 2.59) ) * 100
percent_forestation_2016
FROM forestation
WHERE year = 2016
GROUP BY country_name,
year)
SELECT Count(table_1.country_name)
FROM table_1
WHERE table_1.percent_forestation_2016 >
(SELECT table_1.percent_forestation_2016
FROM table_1
WHERE
table_1.country_name = 'United States')
```