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 **41,282,694.90 km^2** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39,958,245.90 km^2** a loss of **1,324,449.00 km^2**, 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 **1279999.99**).

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
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 **30.67%** to **28,79%.**

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 **527229.06km2**. 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.

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 5 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	541510.00km^2
Indonesia	East Asia & Pacific	282193.98km^2
Myanmar	East Asia & Pacific	107234.00km^2
Nigeria	Sub-Saharan Africa	106506.00km^2
Tanzania	Sub-Saharan Africa	102320.00km^2

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	73
50-75	38
75-100	9

The largest number of countries in 2016 were found in the **first** 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

Write out a set of recommendations as an analyst on the ForestQuery team.

- *What have you learned from the World Bank data?*

The world has decreased its forest-area from 1990 to 2016 by 3.2%. While some countries are trying to designate more and more land as forest over the years. China, the United States and small countries like Iceland are the top deforestation countries.
Nevertheless the highest forestation takes place mainly in Latin America and the Caribbean, probably due to economical reasons and the high demand of wood in the world.

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

It would be recommended to focus more on countries that have the biggest absolute forest area change or loss, like Brazil, Indonesia, Myanmar, Nigeria or Tanzania.
It might be also good to be aware that the Top 5 Countries Percent Decrease are from the Sub-Saharan Africa Region.
While trying to increase the forest area worldwide, it could be helpful to explore best practises from China to make a significant change in forest area.

5. APPENDIX: SQL Queries Used

```
DROP VIEW IF EXISTS forestation;
CREATE VIEW forestation
AS
(SELECT
f.country_code,
f.country_name,
f.year,
r.region,
r.income_group,
ROUND(f.forest_area_sqkm::numeric,2) as forest_area_sqkm,
ROUND(l.total_area_sq_mi::numeric,2) as total_area_sq_mi,
ROUND((l.total_area_sq_mi * 2.59)::numeric,2) AS total_area_sqkm,
ROUND(((f.forest_area_sqkm) /(l.total_area_sq_mi * 2.59) * 100)::numeric, 2) AS forest_percent
FROM forest_area f
JOIN land_area l
ON f.country_code = l.country_code
AND f.year = l.Year
JOIN regions r
ON l.country_code = r.country_code)
```

1A)

```
SELECT ROUND(SUM(forest_area_sqkm),2)
FROM forestation
WHERE year = 1990
AND country_name = 'World'
```

1B)

```
SELECT ROUND(SUM(forest_area_sqkm),2)
FROM forestation
WHERE year = 2016
AND country_name = 'World'
```

1C)

```
SELECT
((SELECT ROUND(SUM(forest_area_sqkm),2)
FROM forestation
WHERE year = 1990
AND country_name = 'World')-(SELECT ROUND(SUM(forest_area_sqkm),2)
FROM forestation
WHERE year = 2016
AND country_name = 'World')) AS forest_change
FROM forestation
LIMIT 1
```

1D)

```
SELECT
ROUND((SELECT ROUND(SUM(forest_area_sqkm),2)
        FROM forestation
        WHERE year = 1990
        AND country_name = 'World')-
(SELECT ROUND(SUM(forest_area_sqkm),2)
        FROM forestation
        WHERE year = 2016
        AND country_name = 'World')) /
((SELECT ROUND(SUM(forest_area_sqkm),2)
        FROM forestation
        WHERE year = 1990
        AND country_name = 'World'))*100 AS percent_change
FROM forestation
LIMIT 1
```

1E)

```
SELECT country_name, total_area_sqkm
FROM forestation
WHERE total_area_sqkm <= 1324449.00
GROUP BY 1,2
ORDER BY 2 DESC
LIMIT 1
```

2A)

```
SELECT country_name, ROUND(((SUM(forest_area_sqkm)/SUM(total_area_sqkm))*100),2) AS
pct_forest_area
FROM forestation
WHERE year = 2016
AND country_name = 'World'
GROUP BY country_name

SELECT region, ROUND(((SUM(forest_area_sqkm)/SUM(total_area_sqkm))*100),2) AS pct_forest_area
FROM forestation
WHERE year = 2016
GROUP BY region
ORDER BY pct_forest_area DESC
LIMIT 1

SELECT region, ROUND(((SUM(forest_area_sqkm)/SUM(total_area_sqkm))*100),2) AS pct_forest_area
FROM forestation
WHERE year = 2016
GROUP BY region
ORDER BY pct_forest_area ASC
LIMIT 1
```

2B)

```
SELECT country_name, ROUND(((SUM(forest_area_sqkm)/SUM(total_area_sqkm))*100),2) AS
pct_forest_area
FROM forestation
WHERE year = 1990
AND country_name = 'World'
GROUP BY country_name

SELECT region, ROUND(((SUM(forest_area_sqkm)/SUM(total_area_sqkm))*100),2) AS pct_forest_area
FROM forestation
WHERE year = 1990
GROUP BY region
ORDER BY pct_forest_area DESC
LIMIT 1

SELECT region, ROUND(((SUM(forest_area_sqkm)/SUM(total_area_sqkm))*100),2) AS pct_forest_area
FROM forestation
WHERE year = 1990
GROUP BY region
ORDER BY pct_forest_area ASC
LIMIT 1
```

Table 2.1

```
SELECT region, ROUND(((SUM(forest_area_sqkm)/SUM(total_area_sqkm))*100),2) AS pct_forest_area
FROM forestation
WHERE year = 1990
GROUP BY region
ORDER BY pct_forest_area DESC

SELECT region, ROUND(((SUM(forest_area_sqkm)/SUM(total_area_sqkm))*100),2) AS pct_forest_area
FROM forestation
WHERE year = 2016
GROUP BY region
ORDER BY pct_forest_area DESC
```

3A)

```
CREATE VIEW f2016 AS
SELECT country_name, forest_area_sqkm as forest2016
from forestation
WHERE year = 2016
AND forest_area_sqkm IS NOT NULL
GROUP BY country_name, forest_area_sqkm
ORDER BY forest_area_sqkm DESC

CREATE VIEW f1990 AS
SELECT country_name, forest_area_sqkm as forest1990
from forestation
WHERE year = 1990
AND forest_area_sqkm IS NOT NULL
GROUP BY country_name, forest_area_sqkm
ORDER BY forest_area_sqkm DESC
```

SELECT a.country_name , c.region, SUM(forest2016-forest1990) as forest_change
FROM f2016 as a
JOIN f1990 as b
ON a.country_name =b.country_name
JOIN regions c
ON c.country_name =b.country_name
GROUP BY 1,2
ORDER BY forest_change DESC

TABLE 3.1

```
SELECT a.country_name , c.region,  SUM(forest2016-forest1990) as forest_change
FROM f2016 as a
JOIN f1990 as b
ON a.country_name =b.country_name
JOIN regions c
ON c.country_name =b.country_name
WHERE NOT a.country_name = 'World'
GROUP BY a.country_name, c.region
ORDER BY 3
LIMIT 5
```

3A.2)

```
CREATE VIEW pct2016 AS
SELECT country_name, region, year, (SUM(forest_area_sqkm)/SUM(total_area_sqkm)*100) as
pct_forest2016
FROM forestation
WHERE year = 2016
GROUP BY 1,2,3

CREATE VIEW pct1990 AS
SELECT country_name, region, year, (SUM(forest_area_sqkm)/SUM(total_area_sqkm)*100) as
pct_forest1990
FROM forestation
WHERE year = 1990
GROUP BY 1,2,3
```

SELECT a.country_name , a.region,
ROUND((((pct_forest1990-pct_forest2016)/pct_forest1990)*100),2) as pct_forest_change
FROM pct2016 as a
JOIN pct1990 as b
ON a.country_name =b.country_name
WHERE pct_forest1990 IS NOT NULL AND pct_forest2016 IS NOT NULL
GROUP BY 1,2,3
ORDER BY pct_forest_change asc

TABLE 3.2

```
SELECT a.country_name , a.region, ROUND((((pct_forest1990-pct_forest2016)/pct_forest1990)*100),2)
as pct_forest_change
FROM pct2016 as a
JOIN pct1990 as b
ON a.country_name =b.country_name
WHERE pct_forest1990 IS NOT NULL AND pct_forest2016 IS NOT NULL
GROUP BY 1,2,3
ORDER BY pct_forest_change DESC
LIMIT 5
```

TABLE 3.3

```
SELECT DISTINCT(quartiles), COUNT(country_name) OVER (PARTITION BY quartiles) AS
country_count
FROM
(SELECT country_name,
CASE
    WHEN pct_forest2016 < 25 THEN '0-25'
    WHEN pct_forest2016 >= 25 AND pct_forest2016 < 50 THEN '25-50'
    WHEN pct_forest2016 >= 50 AND pct_forest2016 < 75 THEN '50-75'
    ELSE '75-100'
 END AS quartiles
 FROM pct2016
 WHERE pct_forest2016 IS NOT NULL ) sub
GROUP BY quartiles, country_name
ORDER BY country_count DESC
```

TABLE 3.4

```
SELECT country_name, ROUND(pct_forest2016, 2)
FROM pct2016
WHERE pct_forest2016 IS NOT NULL
ORDER BY pct_forest2016 DESC
LIMIT 9
```