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** sq km in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9** sq km, a loss **1324449**, or **3.2**%.

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 sq km**).

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 **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** sq km. 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** sq km, 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 **213.6645**% 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	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	61.80

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.

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 **nine** 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	98.25769
Micronesia, Fed. Sts.	East Asia & Pacific	91.85724
Gabon	Sub-Saharan Africa	90.03764
Seychelles	Sub-Saharan Africa	88.41114
Palau	East Asia & Pacific	87.60681
American Samoa	East Asia & Pacific	87.50009
Guyana	Latin America & Caribbean	83.90145
Lao PDR	East Asia & Pacific	82.10823
Solomon Islands	East Asia & Pacific	77.86352

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?*

From 1990 to 2016, overall, the world has lost forest area primarily because of loss of cover in few regions like Latin America & Caribbean and Sub-Saharan Africa. The loss in these regions have been offset by other regions. There has been drastic decrease in countries like Brazil, Nigeria, Myanmar, Indonesia, and Tanzania. I believe we should focus on these countries and help them to recover the loss in forest land.

5. RECOMMENDATIONS

```
CREATE VIEW forestation AS
SELECT fa.country_name,
fa.year,
fa.forest_area_sqkm,
la.total_area_sq_mi,
r.region,
r.income_group,
(fa.forest_area_sqkm/la.total_area_sq_mi*2.59)*100 forest_designated
FROM forest_area fa
JOIN land_area la ON la.country_code = fa.country_code AND la.year = fa.year
JOIN regions r ON r.country_code = fa.country_code
GROUP BY fa.year,
fa.country_name,
r.income_group,
r.region,
la.total_area_sq_mi,
fa.forest_area_sqkm
```

1. GLOBAL SITUATION

a. 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 SUM(forest_area_sqkm)
FROM forestation
WHERE YEAR = 1990
AND country_name = 'World'
```

b. What was the total forest area (in sq km) of the world in 2016? Please keep in mind that you can use the country record in the table is denoted as “World.”

```
SELECT SUM(forest_area_sqkm)
FROM forestation
WHERE YEAR = 2016
AND country_name = 'World'
```

c. What was the change (in sq km) in the forest area of the world from 1990 to 2016?

```
SELECT(
```

```
        (SELECT SUM(forest_area_sqkm)
        FROM forestation
        WHERE YEAR = 1990
        AND country_name = 'World')
            -(SELECT SUM(forest_area_sqkm)
            FROM forestation
        WHERE YEAR = 2016
        AND country_name = 'World')) as change_in_forestation
FROM forestation
LIMIT 1
```

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

```
SELECT((
        (SELECT SUM(forest_area_sqkm)
        FROM forestation
        WHERE YEAR = 1990
        AND country_name = 'World')
                -(SELECT SUM(forest_area_sqkm)
                FROM forestation
                WHERE YEAR = 2016
                AND country_name = 'World'))/
                        ((SELECT SUM(forest_area_sqkm)
                        FROM forestation
                        WHERE YEAR = 1990
                        AND country_name = 'World'))*100) as perc_change_in_forestation
FROM forestation
LIMIT 1
```

e. 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 country_name, total_area_sq_mi * 2.59 as total_area_sq_km
FROM forestation
WHERE YEAR = 2016 AND total_area_sq_mi * 2.59 <= 1324449
ORDER BY total_area_sq_km DESC
LIMIT 1
```

2. REGIONAL OUTLOOK

a. 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 country_name,
ROUND((CAST((Sum(forest_area_sqkm)/Sum(total_area_sq_mi*2.59)) AS
NUMERIC)*100),2) AS forest_perc
FROM forestation
WHERE YEAR = 2016
AND country_name = 'World'
GROUP BY country_name
```

```
SELECT region,
ROUND((CAST((Sum(forest_area_sqkm)/Sum(total_area_sq_mi*2.59)) AS
NUMERIC)*100),2) AS forest_perc
FROM forestation
WHERE YEAR = 2016
GROUP BY region
ORDER BY forest_perc DESC
```

```
SELECT region,
ROUND((CAST((Sum(forest_area_sqkm)/Sum(total_area_sq_mi*2.59)) AS
NUMERIC)*100),2) AS forest_perc
FROM forestation
WHERE YEAR = 2016
GROUP BY region
ORDER BY forest_perc ASC
```

b. 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 country_name,
ROUND((CAST((Sum(forest_area_sqkm)/Sum(total_area_sq_mi*2.59)) AS
NUMERIC)*100),2) AS forest_perc
FROM forestation
WHERE YEAR = 1990
```

```
AND country_name = 'World'
GROUP BY country_name

SELECT region,
ROUND((CAST((Sum(forest_area_sqkm)/Sum(total_area_sq_mi*2.59)) AS
NUMERIC)*100),2) AS forest_perc
FROM forestation
WHERE YEAR = 1990
GROUP BY region
ORDER BY forest_perc DESC

SELECT region,
ROUND((CAST((Sum(forest_area_sqkm)/Sum(total_area_sq_mi*2.59)) AS
NUMERIC)*100),2) AS forest_perc
FROM forestation
WHERE YEAR = 1990
GROUP BY region
ORDER BY forest_perc ASC
```

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

```
SELECT region,
ROUND((CAST((Sum(forest_area_sqkm)/Sum(total_area_sq_mi*2.59)) AS
NUMERIC)*100),2) AS forest_perc
FROM forestation
WHERE YEAR = 1990
GROUP BY region
ORDER BY forest_perc DESC

SELECT region,
ROUND((CAST((Sum(forest_area_sqkm)/Sum(total_area_sq_mi*2.59)) AS
NUMERIC)*100),2) AS forest_perc
FROM forestation
WHERE YEAR = 2016
GROUP BY region
ORDER BY forest_perc DESC
```

3. COUNTRY-LEVEL DETAIL

SUCCESS STORIES

```
WITH fa_1990 AS
        (SELECT country_name,
        (SUM(forest_area_sqkm)) AS total_forest_area_1990
        FROM forestation
        WHERE year = 1990
    GROUP BY country_name),
fa_2016 AS
        (SELECT country_name,
        (SUM(forest_area_sqkm)) AS total_forest_area_2016
        FROM forestation
        WHERE year = 2016
    GROUP BY country_name)
SELECT fa_1990.country_name,
(total_forest_area_2016 - total_forest_area_1990) change_in_forest_area
FROM fa_1990
JOIN fa_2016 ON fa_1990.country_name = fa_2016.country_name
WHERE total_forest_area_2016 IS NOT NULL AND total_forest_area_1990 IS NOT
NULL
ORDER BY change_in_forest_area DESC
LIMIT 2
```

```
WITH fa_1990 AS
        (SELECT country_name,
        (SUM(forest_area_sqkm)) AS total_forest_area_1990
        FROM forestation
        WHERE year = 1990
    GROUP BY country_name),
fa_2016 AS
        (SELECT country_name,
        (SUM(forest_area_sqkm)) AS total_forest_area_2016
        FROM forestation
        WHERE year = 2016
    GROUP BY country_name)
SELECT fa_1990.country_name,
((total_forest_area_2016 - total_forest_area_1990)/(total_forest_area_1990))*100
perc_change_in_forest_area
```

```
FROM fa_1990
JOIN fa_2016 ON fa_1990.country_name = fa_2016.country_name
WHERE total_forest_area_2016 IS NOT NULL AND total_forest_area_1990 IS NOT NULL
ORDER BY perc_change_in_forest_area DESC
LIMIT 2
```

LARGEST CONCERS

a. 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 fa_1990 AS
        (SELECT country_name, region,
        (SUM(forest_area_sqkm)) AS total_forest_area_1990
        FROM forestation
        WHERE year = 1990
   GROUP BY country_name, region),
fa_2016 AS
        (SELECT country_name, region,
        (SUM(forest_area_sqkm)) AS total_forest_area_2016
        FROM forestation
        WHERE year = 2016
   GROUP BY country_name, region)
SELECT fa_1990.country_name, fa_1990.region,
((total_forest_area_1990 - total_forest_area_2016)) decrease_in_forest_area
FROM fa_1990
JOIN fa_2016 ON fa_1990.country_name = fa_2016.country_name
WHERE total_forest_area_2016 IS NOT NULL AND total_forest_area_1990 IS NOT NULL AND
fa_2016.country_name != 'World'
ORDER BY decrease_in_forest_area DESC
LIMIT 5
```

b. 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 fa_1990 AS
        (SELECT country_name, region,
        (SUM(forest_area_sqkm)) AS total_forest_area_1990
        FROM forestation
        WHERE year = 1990
   GROUP BY country_name, region),
fa_2016 AS
        (SELECT country_name, region,
        (SUM(forest_area_sqkm)) AS total_forest_area_2016
```

```
        FROM forestation
        WHERE year = 2016
   GROUP BY country_name, region)
SELECT fa_1990.country_name, fa_1990.region,
((total_forest_area_1990 - total_forest_area_2016)/total_forest_area_1990) *100
perc_decrease_in_forest_area
FROM fa_1990
JOIN fa_2016 ON fa_1990.country_name = fa_2016.country_name
WHERE total_forest_area_2016 IS NOT NULL AND total_forest_area_1990 IS NOT NULL AND
fa_2016.country_name != 'World'
ORDER BY perc_decrease_in_forest_area DESC
LIMIT 5
```

c. If countries were grouped by percent forestation in quartiles, which group had the most countries in it in 2016?

```
WITH fa_2016 AS
        (SELECT country_name, year,
        (((forest_area_sqkm)/(total_area_sq_mi*2.59))*100) AS      perc_forestation
        FROM forestation
        WHERE year = 2016
   GROUP BY country_name, year, forest_area_sqkm, total_area_sq_mi)
SELECT DISTINCT(quartiles), count(country_name) OVER (PARTITION BY quartiles)
FROM
(SELECT country_name,
        CASE
        WHEN perc_forestation<25 THEN '0-25'
        WHEN perc_forestation>=25 AND perc_forestation<50 THEN '25-50'
        WHEN perc_forestation>=50 AND perc_forestation<75 THEN '50-75'
        ELSE '75-100'
        END AS quartiles
FROM fa_2016
WHERE perc_forestation IS NOT NULL AND year = 2016 AND country_name !=
'World') sub
```

d. List all of the countries that were in the 4th quartile (percent forest > 75%) in 2016.

```
WITH fa_2016 AS
        (SELECT country_name, year, region,
        (((forest_area_sqkm)/(total_area_sq_mi*2.59))*100) AS      perc_forestation
        FROM forestation
        WHERE year = 2016
   GROUP BY country_name, region, year, forest_area_sqkm, total_area_sq_mi)
```

```
SELECT country_name, region, perc_forestation, count(country_name) OVER (PARTITION BY
quartiles)
FROM
(SELECT country_name, region, perc_forestation,
        CASE
        WHEN perc_forestation<25 THEN '0-25'
        WHEN perc_forestation>=25 AND perc_forestation<50 THEN '25-50'
        WHEN perc_forestation>=50 AND perc_forestation<75 THEN '50-75'
        ELSE '75-100'
        END AS quartiles
FROM fa_2016
WHERE perc_forestation > 75 AND year = 2016 AND country_name !=
'World') sub
ORDER BY perc_forestation DESC
```