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 sqkm in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39958245.9 sqkm, a loss of 1324449 sqkm, or 3.20824258980244%

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 sqkm).

2. **REGIONAL OUTLOOK**

In 2016, the percent of the total land area of the world designated as forest was 31.4%. The region with the highest relative forestation was Latin America and the Caribbean, with 46.16%, and the region with the lowest relative forestation was Middle East and North Africa, with 2.068% 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 and the Caribbean, with 51.029%, and the region with the lowest relative forestation was Middle East and North Africa, with 1.775% forestation.

Table 2.1: Percent Forest Area by Region, 1990 & 2016:

Region	1990 Forest Percentage	2016 Forest Percentage
Latin America & Caribbean	51.0299798667514	46.1620721996047
Europe & Central Asia	37.2839398564019	38.0414216032517
North America	35.6511790009015	36.0393609681438
World	32.4222035575689	31.3755709643095
Sub-Saharan Africa	30.6741454610006	28.7881883550464
East Asia & Pacific	25.7760953973175	26.3586765000485
South Asia	16.510767001421	17.5058634081534
Middle East & North Africa	1.77524062469353	2.06826486871501

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 (30.7% to 28.8%). 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 31.4%.

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 527229.062 kmsq. 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, much lower than the figure for China.

United States and China 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 213.664% 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 in sqkm
Brazil	Latin America & Caribbean	541510
Indonesia	East Asia & Pacific	282193.9844
Myanmar	East Asia & Pacific	107234.0039
Nigeria	Sub-Saharan Africa	106506.00098
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	59.27
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
1 (0-25)	85
2 (25-50)	73
3 (50-75)	38
4 (75-100)	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
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?*
- *Which countries should we focus on over others?*

I have learned that there is a lot more forest area being grown around in specific regions where people think nature is being lost. Also the decrease in forest area in the world minimizes the actual danger of other regions which have lost an extraordinary amount of forest area.

I would focus on countries in the regions of Latin American, the Caribean, and Sub-saharan Africa because those are the regions with the biggest decrease in forest area and It would be important to focus on growing more there.

6. APPENDIX

VIEW)

```
CREATE VIEW Forest 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) pct
FROM forest_area f
JOIN land_area l ON f.country_code = l.country_code
AND f.year = l.year
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
```

1d)
```
SELECT country_name,
        SUM(total_area_sq_mi * 2.59) AS total_area_sq_km
FROM land_area
WHERE year = 2016 AND total_area_sq_mi IS NOT NULL
GROUP BY country_name
ORDER BY total_area_sq_km DESC
```

2a)
```
SELECT f.country_name,
        (Sum(f.forest_area_sqkm) / Sum(l.total_area_sq_mi*2.59))*100 AS percent_forest
FROM forest_area f
JOIN land_area l ON f.country_code = l.country_code AND f.year = l.year
WHERE f.year = 2016 AND f.country_name = 'World'
GROUP BY f.country_name
```

2b)
```
SELECT r.region,
        (Sum(f.forest_area_sqkm) / Sum(l.total_area_sq_mi*2.59))*100 AS percent_forest
 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
 WHERE f.year = 2016
 GROUP BY 1
 ORDER BY percent_forest DESC
```

2c)
```
SELECT f.country_name,
        (Sum(f.forest_area_sqkm) / Sum(l.total_area_sq_mi*2.59))*100 AS percent_forest
FROM forest_area f
JOIN land_area l ON f.country_code = l.country_code AND f.year = l.year
WHERE f.year = 1990 AND f.country_name = 'World'
GROUP BY f.country_name
```

2d)
```
SELECT r.region,
        (Sum(f.forest_area_sqkm) / Sum(l.total_area_sq_mi*2.59))*100 AS percent_forest
 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
 WHERE f.year = 1990
 GROUP BY 1
 ORDER BY percent_forest DESC
```

For table in question 2 I used the full results from 2d and changed 1990 to 2016 and got the results fro 2016 as well.

3a)
```
WITH tbl1 AS
        (SELECT country_name,
                SUM(forest_area_sqkm) AS forest_area_sqkm_1990
         FROM forest_area
         WHERE year = 1990
        GROUP BY country_name),
    tbl2 AS
        (SELECT country_name,
```

```
                SUM(forest_area_sqkm) AS forest_area_sqkm_2016
        FROM forest_area
        WHERE year = 2016
        GROUP BY country_name)

    SELECT t1.country_name,
            (t2.forest_area_sqkm_2016 - t1.forest_area_sqkm_1990) AS change_in_years
    FROM tbl1 t1
    JOIN tbl2 t2 ON t1.country_name = t2.country_name
    WHERE (t2.forest_area_sqkm_2016 - t1.forest_area_sqkm_1990) IS NOT NULL
    ORDER BY change_in_years DESC

3b) WITH T1 AS
        (SELECT f.country_name,
                (SUM(f.forest_area_sqkm) / SUM(l.total_area_sq_mi*2.59))*100 percent_forestation_1
         FROM forest_area f
         JOIN land_area l ON f.country_code = l.country_code AND f.year = l.year
         WHERE f.YEAR = 1990
         GROUP BY f.country_name,
                  f.forest_area_sqkm),
    T2 AS
        (SELECT f.country_name,
                (SUM(f.forest_area_sqkm) / SUM(l.total_area_sq_mi*2.59))*100 percent_forestation_2
        FROM forest_area f
        JOIN land_area l ON f.country_code = l.country_code AND f.year = l.year
         WHERE f.YEAR = 2016
        GROUP BY f.country_name,
                 f.forest_area_sqkm)
   SELECT f.country_name,
           ((t.percent_forestation_2 - f.percent_forestation_1)/(f.percent_forestation_1))*100 percent_change
    FROM T1 f
    JOIN T2 t ON f.country_name = t.country_name
    WHERE ((t.percent_forestation_2 - f.percent_forestation_1)/(f.percent_forestation_1))*100 IS NOT NULL
    ORDER BY percent_change DESC

3c)WITH T1 AS
        (SELECT f.country_name cntry_name,
                 r.region reg_name,
                (SUM(f.forest_area_sqkm) / SUM(l.total_area_sq_mi*2.59))*100 pct1
         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 = l.country_code
         WHERE f.year = 1990
         GROUP BY 1, 2),
   T2 AS
        (SELECT f.country_name cntry_name,
                 r.region reg_name,
                (SUM(f.forest_area_sqkm) / SUM(l.total_area_sq_mi*2.59))*100 pct2
         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 = l.country_code
        WHERE f.YEAR = 2016
        GROUP BY 1, 2)
    SELECT f.cntry_name,
           f.reg_name,
           Round((((f.pct1 - t.pct2)/(f.pct1))*100)::Numeric, 2) pct_change
    FROM T1 f
    JOIN T2 t ON f.cntry_name = t.cntry_name
    WHERE f.pct1 IS NOT NULL AND t.pct2 IS NOT NULL
    GROUP BY 1,2,3
    ORDER BY pct_change DESC

3d) WITH tbl1 AS
        (SELECT f.country_name,
                f.year,
                (SUM(f.forest_area_sqkm) / SUM(l.total_area_sq_mi*2.59))*100 pct
         FROM forest_area f
         JOIN land_area l ON f.country_code = l.country_code AND f.year = l.year
         WHERE f.year = 2016
        GROUP BY 1, 2)

    SELECT Distinct(quartile),
           COUNT(country_name)Over(PARTITION BY quartile)
    FROM
        (SELECT country_name,
                CASE
                WHEN pct<25 THEN '1'
                WHEN pct BETWEEN 25 AND 50 THEN '2'
                WHEN pct BETWEEN 50 AND 75 THEN '3'
                ELSE '4'
                END AS quartile
        FROM tbl1
        WHERE pct IS NOT NULL AND tbl1.year = 2016) sub

3e)WITH tbl1 AS (
        SELECT f.country_name,
                f.year,
                r.region region,
                (SUM(f.forest_area_sqkm) / SUM(l.total_area_sq_mi*2.59))*100 pct
        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
        WHERE  f.year = 2016
        GROUP BY 1,2,3)

    SELECT  a.*,
            CASE
            WHEN pct < 25 THEN '1'
            WHEN pct BETWEEN 25 AND 50 THEN '2'
            WHEN pct BETWEEN 50 AND 75 THEN '3'
```

```
        ELSE '4'
        END AS quartile
FROM tbl1 a
WHERE pct IS NOT NULL
ORDER BY pct DESC
```