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 3.208%.

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 1279999.9891sqkm).

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 American & Carribbean, with 46.16%, and the region with the lowest relative forestation was Middle East and 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 American & Carribbean, with 51.03%, and the region with the lowest relative forestation was Middle East and North Africa,, with 1.78% forestation.

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

Region	1990 Forest Percentage	2016 Forest Percentage
South Asia	16.51	17.51
Sub-Saharan Africa	30.67	28.79

North America	35.65	36.04

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Latin American & 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 527229.062 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 79200 sqkm, 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 68.11% 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 sqkm
Indonesia	East Asia & Pacific	282193.98 sqkm
Myanmar	East Asia & Pacific	107234.0039 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	307.25%
Nigeria	Sub-Saharan Africa	161.77%
Uganda	Sub-Saharan Africa	144.66%

When we consider countries that decreased in forest area 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%	98
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
Solomon Islands	East Asian & Pacific	77.86
Lao PDR	East Asian & Pacific	82.11
Guyana	Latin American & Caribbean	83.90
American Samoa	East Asian & Pacific	87.50
Palau	East Asian & Pacific	87.60
Seychelles	Sub-Saharan Africa	88.41
Gabon	Sub-Saharan Africa	90.03
Micronesia Fed Sts	East Asian & Pacific	91.86
Suriname	Latin American & Caribbean	98.26

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?*

Although certain regions make it appear as if deforestation is a non-issue, because of the incredible decrease in two specific regions, the world as a whole is decreasing. These two areas (mentioned above) tend to have lower SES than other places. Also, the specific countries that are doing the best tend to be lower in actual land and have a tropical climate. When taking all of this information into context, it is easy to see that while certain countries were increasing their overall forestation (i.e. United States) because of their significantly more land availability and SES power, it is on these countries to perform even better with goals of increased forestation percentage year by year as +5% to account for the severe deforestation of other countries like Brazil. However, Brazil and other significant areas of deforestation need to be addressed as well to curb the impact.

6. Appendix

```
CREATE VIEW forestation AS (
SELECT forest_area.country_name AS name,
        forest_area.year AS year_date,
        forest_area.forest_area_sqkm,
```

```
        land_area.total_area_sq_mi*2.59 AS land_sqkm,
        forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 AS
        percent_forest_area, regions.region,
        CASE WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 >=
        75 THEN '75-100'
        WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100
        BETWEEN 50 AND 75 THEN '50-75'
        WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100
        BETWEEN 25 AND 50 THEN '25-50' ELSE '0-25'
        END AS quartile
FROM forest_area
        JOIN land_area
                ON land_area.country_code = forest_area.country_code
                AND land_area.country_name = forest_area.country_name
                AND land_area.year = forest_area.year
        JOIN regions
                ON regions.country_code = land_area.country_code
WHERE forest_area.year ='2016'
GROUP BY name, forest_area.year,
         forest_area.forest_area_sqkm,
        land_sqkm,
        regions.region
ORDER BY percent_forest_area)
```

```
SELECT forest_area_sqkm,
        year,
   LEAD(forest_area_sqkm) OVER (ORDER BY year) AS lead,
   forest_area_sqkm - LEAD(forest_area_sqkm) OVER (ORDER BY year) AS difference,
   ((forest_area_sqkm - LEAD(forest_area_sqkm) OVER (ORDER BY year))/forest_area_sqkm) *
100 AS percent_change
FROM forest_area
WHERE country_name = 'World'
        AND year IN ('1990', '2016')
ORDER BY 2
```

```
SELECT DISTINCT country_name,
                total_area_sq_mi * 2.59 AS land_sq_km,
                year
FROM land_area
WHERE (total_area_sq_mi * 2.59) <= 1324449
                AND year = '2016'
ORDER BY 2 DESC
```

```
LIMIT 1
```

```
SELECT forest_area.country_name AS name,
        forest_area.year AS year_date,
        forest_area.forest_area_sqkm,
        land_area.total_area_sq_mi*2.59 AS land_sqkm,
        forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 AS
        percent_forest_area,
        regions.region
FROM forest_area
        JOIN land_area
                ON land_area.country_code = forest_area.country_code
                        AND land_area.country_name = forest_area.country_name
                        AND land_area.year = forest_area.year
        JOIN regions
                ON regions.country_code = land_area.country_code
WHERE forest_area.year IN ('1990', '2016')
GROUP BY name, forest_area.year,
        forest_area.forest_area_sqkm,
        land_sqkm,
        regions.region
ORDER BY name
```

```
SELECT forest_area.year AS year_date,
SUM(forest_area.forest_area_sqkm)/SUM(land_area.total_area_sq_mi *2.59)*100 AS
percent_forest_area,
        regions.region
FROM forest_area
        JOIN land_area
                ON land_area.country_code = forest_area.country_code
                        AND land_area.country_name = forest_area.country_name
                        AND land_area.year = forest_area.year
        JOIN regions
                ON regions.country_code = land_area.country_code
WHERE forest_area.year IN ('1990', '2016')
GROUP BY regions.region,
        year_date
```

```
SELECT forest_area.year AS year_date,
ROUND((SUM(forest_area.forest_area_sqkm)/SUM(land_area.total_area_sq_mi
*2.59)*100)::numeric,2) AS percent_forest_area,
        regions.region
FROM forest_area
        JOIN land_area
                ON land_area.country_code = forest_area.country_code
                        AND land_area.country_name = forest_area.country_name
                        AND land_area.year = forest_area.year
        JOIN regions
                ON regions.country_code = land_area.country_code
WHERE forest_area.year IN ('1990', '2016')
GROUP BY regions.region, year_date
ORDER BY percent_forest_area,
        regions.region
```

```
SELECT forest_area_sqkm, year,
        country_name,
        LAG(forest_area_sqkm) OVER (PARTITION BY country_name ORDER BY year) AS lag,
        forest_area_sqkm - LAG(forest_area_sqkm) OVER (PARTITION BY country_name ORDER
        BY year) AS difference_forest,
        ((forest_area_sqkm - LAG(forest_area_sqkm) OVER (PARTITION BY country_name
        ORDER BY year))/forest_area_sqkm) * 100 AS percent_change
FROM forest_area
WHERE year IN ('1990', '2016')
ORDER BY percent_change DESC
```

```
SELECT forest_area.forest_area_sqkm,
        forest_area.year,
        forest_area.country_name AS name,
        regions.region,
        LAG(forest_area.forest_area_sqkm) OVER (PARTITION BY forest_area.country_name
        ORDER BY forest_area.year) AS lag,
        forest_area.forest_area_sqkm - LAG(forest_area.forest_area_sqkm) OVER (PARTITION
        BY forest_area.country_name ORDER BY forest_area.year) AS difference_forest,
        ((forest_area.forest_area_sqkm - LAG(forest_area.forest_area_sqkm) OVER (PARTITION
```

```
        BY forest_area.country_name ORDER BY
        forest_area.year))/forest_area.forest_area_sqkm) * 100 AS percent_change
FROM forest_area
        JOIN regions
                ON forest_area.country_code = regions.country_code
WHERE year IN ('1990', '2016')
ORDER BY difference_forest
```

```
SELECT forest_area.forest_area_sqkm,
        forest_area.year,
        forest_area.country_name AS name,
        regions.region,
        LAG(forest_area.forest_area_sqkm) OVER (PARTITION BY forest_area.country_name
        ORDER BY forest_area.year) AS lag,
        forest_area.forest_area_sqkm - LAG(forest_area.forest_area_sqkm) OVER (PARTITION
        BY forest_area.country_name ORDER BY forest_area.year) AS difference_forest,
        ((forest_area.forest_area_sqkm - LAG(forest_area.forest_area_sqkm) OVER (PARTITION
        BY forest_area.country_name ORDER BY
        forest_area.year))/forest_area.forest_area_sqkm) * 100 AS percent_change
FROM forest_area
        JOIN regions
                ON forest_area.country_code = regions.country_code
WHERE year IN ('1990', '2016')
ORDER BY percent_change
```

```
SELECT forest_area.country_name AS name,
        forest_area.year AS year_date,
        forest_area.forest_area_sqkm, land_area.total_area_sq_mi*2.59 AS land_sqkm,
        forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 AS
        percent_forest_area, regions.region,
        CASE WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 >=
        75 THEN '75-100'
        WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100
        BETWEEN 50 AND 75 THEN '50-75'
        WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100
        BETWEEN 25 AND 50 THEN '25-50'
```

```
        ELSE '0-25'
        END AS quartile
FROM forest_area
        JOIN land_area
                ON land_area.country_code = forest_area.country_code
                        AND land_area.country_name = forest_area.country_name
                        AND land_area.year = forest_area.year
        JOIN regions
                ON regions.country_code = land_area.country_code
WHERE forest_area.year ='2016'
GROUP BY name,
        forest_area.year,
        forest_area.forest_area_sqkm,
        land_sqkm,
        regions.region
ORDER BY percent_forest_area
```

```
SELECT forest_area.country_name AS name,
        forest_area.year AS year_date,
        forest_area.forest_area_sqkm,
        land_area.total_area_sq_mi*2.59 AS land_sqkm,
        forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 AS
        percent_forest_area, regions.region,
        CASE WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 >=
        75 THEN '75-100'
        WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100
        BETWEEN 50 AND 75 THEN '50-75'
        WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100
        BETWEEN 25 AND 50 THEN '25-50'
        ELSE '0-25'
        END AS quartile
FROM forest_area
        JOIN land_area
                ON land_area.country_code = forest_area.country_code
                        AND land_area.country_name = forest_area.country_name
                        AND land_area.year = forest_area.year
        JOIN regions
```

```
        ON regions.country_code = land_area.country_code
WHERE forest_area.year ='2016'
GROUP BY name,
        forest_area.year,
        forest_area.forest_area_sqkm,
        land_sqkm,
        regions.region
HAVING forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 > 75
ORDER BY percent_forest_area
```

```
SELECT forest_area.country_name AS name,
        forest_area.year AS year_date,
        forest_area.forest_area_sqkm,
        land_area.total_area_sq_mi*2.59 AS land_sqkm,
        forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 AS
        percent_forest_area, regions.region,
        CASE WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 >=
        75 THEN '75-100'
        WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100
        BETWEEN 50 AND 75 THEN '50-75'
        WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100
        BETWEEN 25 AND 50 THEN '25-50'
        ELSE '0-25'
        END AS quartile
FROM forest_area
        JOIN land_area
                ON land_area.country_code = forest_area.country_code
                        AND land_area.country_name = forest_area.country_name
                        AND land_area.year = forest_area.year
        JOIN regions
                ON regions.country_code = land_area.country_code
WHERE forest_area.year ='2016'
GROUP BY name,
        forest_area.year,
        forest_area.forest_area_sqkm,
        land_sqkm,
        regions.region
```

```
HAVING forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 <25
ORDER BY percent_forest_area
```

```
SELECT forest_area.country_name AS name,
        forest_area.year AS year_date,
        forest_area.forest_area_sqkm,
        land_area.total_area_sq_mi*2.59 AS land_sqkm,
        forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 AS
        percent_forest_area, regions.region,
        CASE WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 >=
        75 THEN '75-100'
        WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100
        BETWEEN 50 AND 75 THEN '50-75'
        WHEN forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100
        BETWEEN 25 AND 50 THEN '25-50'
        ELSE '0-25'
        END AS quartile
FROM forest_area
        JOIN land_area
                ON land_area.country_code = forest_area.country_code
                        AND land_area.country_name = forest_area.country_name
                        AND land_area.year = forest_area.year
        JOIN regions
                ON regions.country_code = land_area.country_code
WHERE forest_area.year ='2016'
GROUP BY name,
        forest_area.year,
        forest_area.forest_area_sqkm,
        land_sqkm,
        regions.region
HAVING forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 <50 AND
forest_area.forest_area_sqkm/(land_area.total_area_sq_mi *2.59)*100 >25
ORDER BY percent_forest_area
```