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 of 1324449 sq km, 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 494208.49).

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
Sub-Saharan Africa	30.65	28.72

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 (30.65% to 28.72%). 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 527229.06 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, 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 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	-282193.98
Myanmar	East Asia & Pacific	-107234.00
Nigeria	Sub-Saharan Africa	-106506.00
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 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	85
2	73
3	38
4	22

The largest number of countries in 2016 were found in the 1st and 2nd quartile.

There were 22 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	87.62
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

Countries with low levels of economic security tend to have a greater problem, but also areas that have problems with deforestation, unsustainable logging, agricultural expansion, or urbanization. We can see that countries in Latin America and the Sub-Saharan Africa regions reflect this statement, where the highest decrease in forestation area tends to be places with lower economic power. In order to attempt to help their reforestation efforts, there would need to be a focus on sustainable agriculture, ranching practices, and enforcement of anti-deforestation laws. Not only that, it is important to partner with countries that had successful reforestation efforts.

5. APPENDIX: SQL Queries Used

Section 1:
Two temporary tables were created in order to answer the questions, these tables were then used to calculate the value needed to answer the questions.

```
WITH WLD1 AS (
   SELECT country_name, forest_area_sqkm
   FROM forest_area
   WHERE country_name = 'World' AND year = 2016
),
WLD2 AS (
   SELECT country_name, forest_area_sqkm
   FROM forest_area
   WHERE country_name = 'World' AND year = 1990
)

 - - This query calculates the change in size of forest area.
SELECT (WLD1.forest_area_sqkm - WLD2.forest_area_sqkm) AS difference
FROM WLD1
JOIN WLD2
ON WLD1.country_name = WLD2.country_name;

-- alternatively, we can use a self join to achieve this.
SELECT
   fa1.forest_area_sqkm - fa2.forest_area_sqkm AS difference
FROM forest_area fa1
JOIN forest_area fa2
ON fa1.country_name = fa2.country_name
WHERE fa1.country_name = 'World'
AND fa1.year = 2016
```

```
AND fa2.year = 1990;


 - - This query calculates the percentage change in size of forest area.
SELECT (WLD1.forest_area_sqkm - WLD2.forest_area_sqkm)/WLD2.forest_area_sqkm*100
AS difference
FROM WLD1
JOIN WLD2
ON WLD1.country_name = WLD2.country_name;

- - This query used the answer from previous queries to find the region that has the same total
area as the forest area lost.
 SELECT *
    FROM land_area
    WHERE year = 2016 AND total_area_sq_mi <= 1324449/2.59
    ORDER BY total_area_sq_mi desc

Section 2: Query below shows the percentage of forest area versus land area, grouped by
region.

SELECT
    r.region,
    la.year,
    (SUM(fa.forest_area_sqkm) / 2.59) / SUM(la.total_area_sq_mi) * 100 AS percent_forest
FROM forest_area fa
JOIN land_area la
    ON fa.country_name = la.country_name
    AND fa.year = la.year
JOIN regions r
    ON r.country_name = la.country_name
GROUP BY 1, 2
HAVING la.year = 2016 OR la.year = 1990
ORDER BY la.year, percent_forest DESC;



– Below query returns a table of the statistics in 2016 compared with 1990.
WITH f1 AS (SELECT r.region,
fa.year,(SUM(fa.forest_area_sqkm)/2.59)/SUM(la.total_area_sq_mi)*100 as percent_forest
FROM forest_area fa
JOIN land_area la
ON fa.country_name = la.country_name
AND fa.year = la.year
```

```
JOIN regions r
ON r.country_name = la.country_name
GROUP BY 1,2
HAVING fa.year = 1990
ORDER BY 2, 3 DESC)

SELECT
   r.region,
   la.year,
   (SUM(fa.forest_area_sqkm) / 2.59) / SUM(la.total_area_sq_mi) * 100
  AS percent_forest,
   CASE
      WHEN (SUM(fa.forest_area_sqkm) / 2.59) / SUM(la.total_area_sq_mi) * 100 <
f1.percent_forest
      THEN 'decreased'
      ELSE 'increased'
   END AS trend
FROM forest_area fa
JOIN land_area la
   ON fa.country_name = la.country_name
   AND fa.year = la.year
JOIN regions r
   ON r.country_name = la.country_name
JOIN f1
   ON r.region = f1.region
GROUP BY 1, 2, f1.percent_forest
HAVING la.year = 2016
ORDER BY la.year, percent_forest DESC;
```

Section 3
Below queries showcase the difference in forest area and percentage loss grouped by countries.

```
WITH f1 AS (SELECT country_name, year, forest_area_sqkm
FROM forest_area
WHERE year = 1990),
f2 AS (SELECT country_name, year, forest_area_sqkm
FROM forest_area
WHERE year = 2016)

SELECT f1.country_name, f1.forest_area_sqkm prev_area, f2.forest_area_sqkm new_area,
f2.forest_area_sqkm-f1.forest_area_sqkm difference
FROM f1
```

```
JOIN f2
ON f1.country_name = f2.country_name
WHERE f2.forest_area_sqkm-f1.forest_area_sqkm < 0
ORDER BY f2.forest_area_sqkm-f1.forest_area_sqkm ASC
LIMIT 6

– Below query shows the top five countries when it comes to percent loss
SELECT f1.country_name, f1.forest_area_sqkm prev_area, f2.forest_area_sqkm new_area,
f2.forest_area_sqkm-f1.forest_area_sqkm difference,
(f2.forest_area_sqkm-f1.forest_area_sqkm)/f1.forest_area_sqkm*100 percent_loss
FROM f1
JOIN f2
ON f1.country_name = f2.country_name
WHERE f2.forest_area_sqkm-f1.forest_area_sqkm < 0
ORDER BY (f2.forest_area_sqkm-f1.forest_area_sqkm)/f1.forest_area_sqkm*100 ASC
LIMIT 5

–Below query shows the count of countries in each quartile when it comes to forestation
percentage.

WITH forestation_data AS (
   SELECT
      fa.country_name,
      (fa.forest_area_sqkm / 2.59) / NULLIF(la.total_area_sq_mi, 0) * 100 AS percent_forest
   FROM forest_area fa
   JOIN land_area la
      ON fa.country_name = la.country_name
      AND fa.year = la.year
   WHERE fa.year = 2016
),
quartiles_data AS (
SELECT
   country_name,
   CASE
      WHEN percent_forest IS NULL THEN 0
      WHEN percent_forest <= 25 THEN 1
      WHEN percent_forest <= 50 THEN 2
      WHEN percent_forest <= 75 THEN 3
      ELSE 4
   END AS quartiles
FROM forestation_data)

SELECT quartiles, COUNT(*)
```

```
FROM quartiles_data
GROUP BY quartiles
ORDER BY quartiles


– Below is a query that shows all the countries in the fourth quartile:
SELECT *
FROM quartiles_data
WHERE quartile = 4

–Below is a query that shows all the countries with forestation higher than the United States
SELECT COUNT(*)
FROM forestation_data
WHERE percent_forest >
(SELECT percent_forest
FROM forestation_data
WHERE country_name = 'United States')
```