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 **3.2%**.

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 **494208.49 sq mile**).

2. **REGIONAL OUTLOOK**

In 2016, the percentage of the total land area of the world designated as forest was **31.37%**. 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 **1.77%** 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
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 **527229.062 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 **448029.062 sq km**.

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's** forest area increased 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	75.44%
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 **0-25%** 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?*

From the deforestation dataset, I had a better understanding about climate and the overall deforestation over different regions and countries. In my opinion, we should focus on how the successful stories happen in China and countries that have had the greatest increases in forestation rate from 1990 to 2016. In the meantime, the region Sub-Saharan Africa is we want to keep monitoring and should invest in more money and effort to prevent deforestation from getting worse.

6. APPENDIX: SQL queries used

1-1

```
SELECT *
FROM forest_area
WHERE country_name = 'World'
AND (year = 2016 OR year = 1990)
```

1-2

```
SELECT
  f1.forest_area_sqkm - f2.forest_area_sqkm
  AS difference
FROM forest_area AS f1
JOIN forest_area AS f2
  ON  (f1.year = '2016' AND f2.year = '1990'
  AND f1.country_name = 'World' AND f2.country_name = 'World')
```

1-3

```
SELECT *
FROM land_area
WHERE year = 2016 and total_area_sq_mi * 2.59 <= 1324449
ORDER BY total_area_sq_mi desc
```

2-1.

```
SELECT 100*f.forest_area_sqkm / (2.59 * l.total_area_sq_mi) as percentage
FROM forest_area f
JOIN land_area l
ON (f.year = 2016 AND l.year = 2016 AND f.country_name = 'World' AND l.country_name =
'World')
```

2-2.

```
SELECT 100*SUM(f.forest_area_sqkm) / (2.59 * SUM(l.total_area_sq_mi)) as percentage,
r.region
FROM forest_area f
JOIN land_area l
ON f.country_code = l.country_code
JOIN regions r
ON f.country_code = r.country_code
WHERE f.year = 2016 AND l.year = 2016 AND f.country_name != 'World' AND l.country_name
!= 'World'
GROUP BY r.region
ORDER BY percentage DESC
```

2-3.

```
SELECT 100*f.forest_area_sqkm / (2.59 * l.total_area_sq_mi) as percentage
FROM forest_area f
JOIN land_area l
ON (f.year = 1990 AND l.year = 1990 AND f.country_name = 'World' AND l.country_name =
'World')
```

2-4.

```
SELECT 100*SUM(f.forest_area_sqkm) / (2.59 * SUM(l.total_area_sq_mi)) as percentage,
r.region
FROM forest_area f
JOIN land_area l
ON f.country_code = l.country_code
JOIN regions r
ON f.country_code = r.country_code
WHERE f.year = 1990 AND l.year = 1990 AND f.country_name != 'World' AND l.country_name
!= 'World'
GROUP BY r.region
ORDER BY percentage DESC
```

3-1

```
SELECT f1.country_name, f1.forest_area_sqkm - f2.forest_area_sqkm diff
```

```
FROM forest_area f1, forest_area f2
WHERE f1.country_name = f2.country_name AND f1.year = 1990 AND f2.year = 2016
ORDER BY diff DESC
```

3-2

```
SELECT f1.country_name, 100*(f1.forest_area_sqkm -
f2.forest_area_sqkm)/f1.forest_area_sqkm diff
FROM forest_area f1, forest_area f2
WHERE f1.country_name = f2.country_name AND f1.year = 1990 AND f2.year = 2016
ORDER BY diff DESC
```

3-3

```
DROP VIEW IF EXISTS percentage_table;
CREATE VIEW percentage_table AS
SELECT f.country_name country, 100.0*(f.forest_area_sqkm /
  (l.total_area_sq_mi * 2.59)) AS percentage
FROM forest_area f
JOIN land_area l
ON (f.country_name = l.country_name AND f.year = l.year AND f.year = 2016);

SELECT distinct(quartiles), COUNT(country) OVER (PARTITION BY quartiles)
FROM(SELECT country,
  CASE WHEN percentage <= 25 THEN '0-25%'
  WHEN percentage <= 75 AND percentage > 50 THEN '50-75%'
  WHEN percentage <= 50 AND percentage > 25 THEN '25-50%'
  ELSE '75-100%'
END AS quartiles FROM percentage_table) t
```

3-4

```
DROP VIEW IF EXISTS percentage_table;
CREATE VIEW percentage_table AS
SELECT f.country_name country, 100.0*(f.forest_area_sqkm /
  (l.total_area_sq_mi * 2.59)) AS percentage
FROM forest_area f
JOIN land_area l
ON (f.country_name = l.country_name AND f.year = l.year AND f.year = 2016);

SELECT p.country, r.region, p.percentage
FROM percentage_table p
   JOIN regions r
   ON p.country = r.country_name
WHERE p.percentage >= 75
   ORDER BY p.percentage DESC
```