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 km^2**_ in 1990. As of 2016, the most recent year for which data was available, that number had fallen to _**39958245.9 km^2**_, a loss of _**1324449 km^2**_, 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 _**1279999.98 km^2**_).

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-Sahara 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 km^2**_. 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 km^2**_, 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 _**213.66**_% 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 km^2
Indonesia	East Asia & Pacific	282193.98 km^2
Myanmar	East Asia & Pacific	107234 km^2
Nigeria	Sub-Saharan Africa	106506 km^2
Tanzania	Sub-Saharan Africa	102320 km^2

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 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	72
50-75	38
75-100	9

The largest number of countries in 2016 were found in the _**1**st_ 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?**
  In the world there is a deforestation of 3.21%, the regions with the highest deforestation are Latin America & Caribbean and Sub-Sahara Africa. In Latin America, the square areas of deforestation are in Brazil, while in Sub-Sahara there are several countries that contribute to deforestation.
  On the other hand, China and the United States have helped in the afforestation of the planet in terms of square areas, increasing in flora and fauna, although in percentage terms the United States has to improve in the afforestation campaign since 94 countries exceed it. It is also surprising that a small country like Iceland increased in forest area by 213.66% from 1990 to 2016.

- **Which countries should we focus on over others?**
  In Brazil, Indonesia and Nigeria are the countries that should concern us due to the accelerated deforestation in terms of square areas, also in the region of Sub-Saharan Africa they have increased their deforestation significantly in percentage terms.

Appendix

```
CREATE VIEW forestation AS
SELECT f.*, r.region, r.income_group, l.total_area_sq_mi,
l.total_area_sq_mi * 2.59 total_area_sqkm,
(f.forest_area_sqkm * 100 / (l.total_area_sq_mi * 2.59)) 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

1a.
SELECT SUM(forest_area_sqkm) total_forest_area
FROM forestation
WHERE region = 'World' AND year = 1990

1b.
SELECT SUM(forest_area_sqkm) total_forest_area
FROM forestation
WHERE region = 'World' AND year = 2016
```

```sql
1c.
SELECT (SUM(a.forest_area_sqkm) - SUM(b.forest_area_sqkm)) change_forest_area
FROM forestation a
JOIN forestation b
ON a.country_code = b.country_code AND a.region = 'World'
AND a.year = 1990 AND b.year = 2016

1d.
WITH
    forest_area AS (
        SELECT (SUM(a.forest_area_sqkm) - SUM(b.forest_area_sqkm))
change_forest_area
        FROM forestation a
        JOIN forestation b
        ON a.country_code = b.country_code AND a.region = 'World'
        AND a.year = 1990 AND b.year = 2016
    )
SELECT ((SELECT * FROM forest_area) * 100 / SUM(forest_area_sqkm))
percent_forest_area
FROM forestation
WHERE region = 'World' AND year = 1990

1e.
WITH
    forest_area AS (
        SELECT (SUM(a.forest_area_sqkm) - SUM(b.forest_area_sqkm))
change_forest_area
        FROM forestation a
        JOIN forestation b
        ON a.country_code = b.country_code AND a.region = 'World'
        AND a.year = 1990 AND b.year = 2016
    )
SELECT country_name, total_area_sqkm
FROM forestation
WHERE year = 2016 AND (SELECT change_forest_area FROM forest_area) >=
total_area_sqkm
ORDER BY total_area_sqkm DESC
LIMIT 1

2a.
SELECT ROUND(SUM(percent_forest)::Numeric, 2) percent_forest_area
FROM forestation
WHERE region = 'World' AND year = 2016
```

```sql
SELECT region, ROUND((SUM(forest_area_sqkm) * 100 /
SUM(total_area_sqkm))::Numeric, 2) percent_forest_area
FROM forestation
WHERE year = 2016
GROUP BY region
ORDER BY percent_forest_area DESC

2b.
SELECT ROUND(SUM(percent_forest)::Numeric, 2) percent_forest_area
FROM forestation
WHERE region = 'World' AND year = 1990

SELECT region, ROUND((SUM(forest_area_sqkm) * 100 /
SUM(total_area_sqkm))::Numeric, 2) percent_forest_area
FROM forestation
WHERE year = 1990
GROUP BY region
ORDER BY percent_forest_area DESC

2c.
WITH
    forest_area_2016 AS (
        SELECT region, ROUND((SUM(forest_area_sqkm) * 100 /
SUM(total_area_sqkm))::Numeric, 2) percent_forest_area
        FROM forestation
        WHERE year = 2016
        GROUP BY region
    ),
    forest_area_1990 AS (
        SELECT region, ROUND((SUM(forest_area_sqkm) * 100 /
SUM(total_area_sqkm))::Numeric, 2) percent_forest_area
        FROM forestation
        WHERE year = 1990
        GROUP BY region
    )
SELECT a.region, b.percent_forest_area percent_forest_1990, a.percent_forest_area
percent_forest_2016
FROM forest_area_2016 a
JOIN forest_area_1990 b
ON a.region = b.region
WHERE a.percent_forest_area < b.percent_forest_area

3a.
WITH
    forest_area_2016 AS (
```

```sql
        SELECT country_name, SUM(forest_area_sqkm) forest_area
        FROM forestation
        WHERE year = 2016
        GROUP BY country_name
    ),
    forest_area_1990 AS (
        SELECT country_name, SUM(forest_area_sqkm) forest_area
        FROM forestation
        WHERE year = 1990
        GROUP BY country_name
    )
SELECT a.country_name, (a.forest_area - b.forest_area) diff_forest_area
FROM forest_area_2016 a
JOIN forest_area_1990 b
ON a.country_name = b.country_name
WHERE (a.forest_area - b.forest_area) IS NOT NULL
ORDER BY diff_forest_area DESC
LIMIT 5

3b.
WITH
    forest_area_2016 AS (
        SELECT country_name, SUM(percent_forest) percent_forest_area
        FROM forestation
        WHERE year = 2016
        GROUP BY country_name
    ),
    forest_area_1990 AS (
        SELECT country_name, SUM(percent_forest) percent_forest_area
        FROM forestation
        WHERE year = 1990
        GROUP BY country_name
    )
SELECT a.country_name, ROUND(((a.percent_forest_area - b.percent_forest_area) *
100 / b.percent_forest_area)::Numeric, 2)  diff_forest_area
FROM forest_area_2016 a
JOIN forest_area_1990 b
ON a.country_name = b.country_name
WHERE (a.percent_forest_area - b.percent_forest_area) IS NOT NULL
ORDER BY diff_forest_area DESC
LIMIT 5

Table 3.1
WITH
    forest_area_2016 AS (
```

```sql
        SELECT country_name, region, SUM(forest_area_sqkm) forest_area
        FROM forestation
        WHERE year = 2016
        GROUP BY country_name, region
    ),
    forest_area_1990 AS (
        SELECT country_name, region, SUM(forest_area_sqkm) forest_area
        FROM forestation
        WHERE year = 1990
        GROUP BY country_name, region
    )
SELECT a.country_name, a.region, (b.forest_area - a.forest_area) "Absolute Forest
Area Change"
FROM forest_area_2016 a
JOIN forest_area_1990 b
ON a.country_name = b.country_name
WHERE (a.forest_area - b.forest_area) IS NOT NULL AND a.country_name != 'World'
ORDER BY "Absolute Forest Area Change" DESC
LIMIT 5

Table 3.2
WITH
    forest_area_2016 AS (
        SELECT country_name, region, SUM(percent_forest) percent_forest_area
        FROM forestation
        WHERE year = 2016
        GROUP BY country_name, region
    ),
    forest_area_1990 AS (
        SELECT country_name, region, SUM(percent_forest) percent_forest_area
        FROM forestation
        WHERE year = 1990
        GROUP BY country_name, region
    )
SELECT a.country_name, a.region, ROUND(((b.percent_forest_area -
a.percent_forest_area) * 100 / b.percent_forest_area)::Numeric, 2) "Pct Forest
Area Change"
FROM forest_area_2016 a
JOIN forest_area_1990 b
ON a.country_name = b.country_name
WHERE (a.percent_forest_area - b.percent_forest_area) IS NOT NULL AND
a.country_name != 'World'
ORDER BY "Pct Forest Area Change" DESC
LIMIT 5
```

```
3c.
WITH
    forest_quartile AS (
        SELECT CASE WHEN percent_forest >= 75 THEN '75-100'
        WHEN percent_forest >= 50 THEN '50-75'
        WHEN percent_forest >= 25 THEN '25-50'
        ELSE '0-25' END AS quartile, country_name
        FROM forestation
        WHERE year = 2016 AND country_name != 'World' AND percent_forest IS NOT
NULL
    )
SELECT DISTINCT (quartile), COUNT(*) OVER (PARTITION BY quartile) AS "Number of
Countries"
FROM forest_quartile
ORDER BY quartile

3d.
SELECT country_name, region, ROUND(percent_forest::Numeric, 2) "Pct Designated as
Forest"
FROM forestation
WHERE year = 2016 AND country_name != 'World' AND percent_forest IS NOT NULL
AND percent_forest >= 75
ORDER BY percent_forest DESC

3e.
SELECT count(*)
FROM forestation
WHERE year = 2016 AND country_name != 'World' AND percent_forest IS NOT NULL
AND percent_forest > (SELECT percent_forest FROM forestation WHERE country_name =
'United States' AND year = 2016)
```