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 km²** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9 km²**, a loss of **1324449 km²**, or **3.21%**.

The forest area lost over this time period is slightly more than the entire land area of **1279999.9891 km²** listed for the year 2016 (which is **Peru**).

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
Middle East & North Africa	**1.78%**	**2.07%**
South Asia	**16.51%**	**17.51%**
East Asia & Pacific	**25.78%**	**26.36%**
Sub-Saharan Africa	**30.67%**	**28.79%**
World	**32.42%**	**31.38%**
North America	**35.65%**	**36.04%**
Europe & Central Asia	**37.28%**	**38.04%**
Latin America & Caribbean	**51.03%**	**46.16%**

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 **527229.0619999999 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 **448029.0619999999 km^2**.

Russian Federation 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 **213.66%** 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**	**282193.9844 km^2**
Myanmar	**East Asia & Pacific**	**107234.0039 km^2**
Nigeria	**Sub-Saharan Africa**	**106506.001 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**	**307.25**
Nigeria	**Sub-Saharan Africa**	**161.78**
Uganda	**Sub-Saharan Africa**	**144.67**
Mauritania	**Sub-Saharan Africa**	**87.78**
Honduras	**Latin America & Caribbean**	**81.93**

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
Q1 (<25)	**84**
Q2 (25-50)	**73**
Q3 (50-75)	**38**
Q4 (>75)	**9**

The largest number of countries in 2016 were found in the **Q1 (<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**

4. RECOMMENDATIONS

Write out a set of recommendations as an analyst on the ForestQuery team.

- *What have you learned from the World Bank data?*
- **Deforestation Trends**: We observe significant deforestation in countries like Brazil, Indonesia, and Nigeria. These nations have experienced the highest loss of forest area in absolute terms from 1990 to 2016.
- **Forest Area Increase**: Interestingly, some countries such as China and India have shown an increase in forest areas due to reforestation efforts and policies.
- **Percentage of Forest Area**: Countries with the highest forest percentages like Suriname and Guyana highlight the importance of preservation efforts in these areas.
- *Which countries should we focus on over others?*
- **Nigeria**: Efforts should focus on reforestation and managing urban expansion to preserve remaining forest areas.
- **Brazil**: As the country with the largest decrease in forest area, targeted reforestation and sustainable land-use policies are critical.

5. APPENDIX: SQL Queries Used

Prepare section (create ‘forestation’ view)

```
CREATE VIEW forestation AS
SELECT
    forest_area.country_code,
    forest_area.country_name,
    forest_area.year,
    forest_area.forest_area_sqkm,
    land_area.total_area_sq_mi,
    regions.region,
    regions.income_group,
    ROUND(CAST((forest_area.forest_area_sqkm / (land_area.total_area_sq_mi *
2.59)) * 100 AS numeric), 2) AS forest_percentage
FROM
    forest_area
JOIN
    land_area ON forest_area.country_code = land_area.country_code AND
forest_area.year = land_area.year
JOIN
    regions ON forest_area.country_code = regions.country_code;
```

1. GLOBAL SITUATION

```sql
SELECT forest_area_sqkm
FROM forestation
WHERE region = 'World'
AND year = 1990;
```

```sql
SELECT forest_area_sqkm
FROM forestation
WHERE region = 'World'
AND year = 2016;
```

```sql
SELECT
    f1.forest_area_sqkm - f2.forest_area_sqkm AS loss_forest_area,
    ROUND(CAST(((f1.forest_area_sqkm - f2.forest_area_sqkm) /
f1.forest_area_sqkm) * 100 AS numeric), 2) AS loss_forest_area_percentage
FROM
    forestation f1
JOIN
    forestation f2
ON
    f1.region = 'World'
    AND f1.year = 1990
    AND f2.region = 'World'
    AND f2.year = 2016;
```

```sql
SELECT
    country_name AS nearest_country_area,
    (total_area_sq_mi * 2.59) AS total_area_sq_km
FROM
    forestation
WHERE
    (total_area_sq_mi * 2.59) <= (
        (SELECT forest_area_sqkm
         FROM forestation
         WHERE region = 'World' AND year = 1990) -
        (SELECT forest_area_sqkm
         FROM forestation
         WHERE region = 'World' AND year = 2016)
    )
    AND year = 2016
ORDER BY
    total_area_sq_mi DESC
LIMIT 1;
```

2. REGIONAL OUTLOOK

```sql
SELECT
    forest_percentage
FROM
    forestation
WHERE
    year = 2016
AND region = 'World';
```

```sql
SELECT
    year,
    region,
    ROUND(CAST((SUM(forest_area_sqkm) / (SUM(total_area_sq_mi) * 2.59)) AS
numeric) * 100, 2) AS forest_area_percentage
FROM
    forestation
GROUP BY
    year,
    region
ORDER BY
    year,
    forest_area_percentage;
```

```sql
SELECT
    forest_percentage
FROM
    forestation
WHERE
    year = 1990
AND region = 'World';
```

3. COUNTRY-LEVEL DETAIL

A. SUCCESS STORIES

```sql
SELECT
    country_name,
    (SELECT forest_area_sqkm
     FROM forestation f2
     WHERE year = 2016 AND f1.country_name = f2.country_name) -
    (SELECT forest_area_sqkm
     FROM forestation f2
     WHERE year = 1990 AND f1.country_name = f2.country_name) AS
increased_forest_area
FROM
    forestation f1
WHERE
    (SELECT forest_area_sqkm
     FROM forestation f2
     WHERE year = 2016 AND f1.country_name = f2.country_name) IS NOT NULL
    AND
    (SELECT forest_area_sqkm
     FROM forestation f2
     WHERE year = 1990 AND f1.country_name = f2.country_name) IS NOT NULL
GROUP BY
    country_name
ORDER BY
increased_forest_area DESC;
```

```sql
SELECT
    country_name,
    total_area_sq_mi
FROM
    forestation f1
WHERE
    year = 2016
    AND total_area_sq_mi <> 0
    AND country_name <> 'World'
ORDER BY
    total_area_sq_mi DESC;
```

```sql
SELECT
    country_name,
    region,
    ROUND(CAST(
        ((SELECT forest_area_sqkm
          FROM forestation f2
          WHERE year = 2016 AND f1.country_name = f2.country_name) -
         (SELECT forest_area_sqkm
          FROM forestation f2
          WHERE year = 1990 AND f1.country_name = f2.country_name)) /
        (SELECT forest_area_sqkm
         FROM forestation f2
         WHERE year = 1990 AND f1.country_name = f2.country_name) * 100 AS
numeric
    ), 2) AS increased_forest_area_percent
FROM
    forestation f1
WHERE
    f1.country_name <> 'World'
    AND (SELECT forest_area_sqkm
         FROM forestation f2
         WHERE year = 2016 AND f1.country_name = f2.country_name) IS NOT NULL
    AND (SELECT forest_area_sqkm
         FROM forestation f2
         WHERE year = 1990 AND f1.country_name = f2.country_name) IS NOT NULL
GROUP BY
    country_name,
    region
ORDER BY
    increased_forest_area_percent DESC
LIMIT 5;
```

B. LARGEST CONCERNS

```
SELECT
country_name,
region,
    (SELECT forest_area_sqkm
     FROM forestation f2
     WHERE year = 1990 AND f1.country_name = f2.country_name) -
    (SELECT forest_area_sqkm
     FROM forestation f2
     WHERE year = 2016 AND f1.country_name = f2.country_name) AS
decreased_forest_area
FROM
    forestation f1
WHERE
    f1.country_name <> 'World'
    AND (SELECT forest_area_sqkm
         FROM forestation f2
         WHERE year = 2016 AND f1.country_name = f2.country_name) IS NOT NULL
    AND (SELECT forest_area_sqkm
         FROM forestation f2
         WHERE year = 1990 AND f1.country_name = f2.country_name) IS NOT NULL
GROUP BY
    country_name, region
ORDER BY
    decreased_forest_area DESC
LIMIT 1;
```

```sql
SELECT
    country_name,
    region,
    ((SELECT forest_area_sqkm
     FROM forestation f2
     WHERE year = 1990 AND f1.country_name = f2.country_name) -
    (SELECT forest_area_sqkm
     FROM forestation f2
     WHERE year = 2016 AND f1.country_name = f2.country_name)) /(SELECT
forest_area_sqkm
     FROM forestation f2
     WHERE year = 2016 AND f1.country_name = f2.country_name) * 100 AS
decreased_forest_area_percent
FROM
    forestation f1
WHERE
    f1.country_name <> 'World'
    AND (SELECT forest_area_sqkm
         FROM forestation f2
         WHERE year = 2016 AND f1.country_name = f2.country_name) IS NOT NULL
    AND (SELECT forest_area_sqkm
         FROM forestation f2
         WHERE year = 1990 AND f1.country_name = f2.country_name) IS NOT NULL
GROUP BY
    country_name, region
ORDER BY
    decreased_forest_area_percent DESC
LIMIT 5;
```

C. QUARTILES

```sql
WITH quartiles AS (
    SELECT
        country_name,
        SUM(forest_percentage) AS pct_forest
    FROM
        forestation
    WHERE
        year = 2016
        AND forest_percentage <> 0
    GROUP BY
        country_name
)
SELECT
    CASE
        WHEN pct_forest < 25 THEN 'Q1 (<25)'
        WHEN pct_forest BETWEEN 25 AND 50 THEN 'Q2 (25-50)'
        WHEN pct_forest BETWEEN 50 AND 75 THEN 'Q3 (50-75)'
        WHEN pct_forest > 75 THEN 'Q4 (>75)'
    END AS quartile,
    COUNT(*) AS count_country
FROM
    quartiles
GROUP BY
    quartile
ORDER BY
count_country DESC;
```

```sql
SELECT
    country_name,
    region,
    forest_percentage
FROM
    forestation
WHERE
    country_name <> 'World'
    AND year = 2016
    AND forest_percentage > 75
ORDER BY
    forest_percentage DESC;
```