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** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9**, a loss of **1324449**, 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 **1279999.99**).

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
East Asia & Pacific	25.7760953973175	26.3586765000485
Europe & Central Asia	37.2839398564019	38.0414216032517
Latin America & Caribbean	51.0299798667514	46.1620721996047
Middle East & North Africa	1.77524062469353	2.06826486871501
North America	35.6511790009015	36.0393609681438
South Asia	16.510767001421	17.5058634081534
Sub-Saharan Africa	30.6741454610006	28.7881883550464
World	32.4222035575689	31.3755709643095

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 **46.17%**) **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 **527229.06**. 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 **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	-282193.9844
Myanmar	East Asia & Pacific	-107234.0039
Nigeria	Sub-Saharan Africa	-106506.00098
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	-75.4452559270073
Nigeria	Sub-Saharan Africa	-61.7999309388418
Uganda	Sub-Saharan Africa	-59.1286034729531
Mauritania	Sub-Saharan Africa	-46.7469879518072
Honduras	Latin America & Caribbean	-45.0344149459194

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 **isHonduras**, 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 **1s (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
American Samoa	East Asia & Pacific	87.5000875000875
Micronesia, Fed. Sts.	East Asia & Pacific	91.8572390715248
Gabon	Sub-Saharan Africa	90.0376418700565
Guyana	Latin America & Caribbean	83.9014489110682
Lao PDR	East Asia & Pacific	82.1082317640861
Palau	East Asia & Pacific	87.6068085491204
Solomon Islands	East Asia & Pacific	77.8635177945067
Suriname	Latin America & Caribbean	98.2576939676578
Seychelles	Sub-Saharan Africa	88.4111367385789

4. RECOMMENDATIONS

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

- *What have you learned from the World Bank data?*
  Forests are gradually diminishing worldwide. Data analysis from 1990 to 2016 highlights a significant reduction in global forest cover, with Sub-Saharan Africa being the most affected region. For instance, Togo experienced a drastic forest reduction of 75.45%. Furthermore, an examination of forestation percentages reveals a concerning trend: 85 countries fall within the lowest quartile, having less than 25% forest cover, while 72 countries are in the second quartile, with forestation levels ranging from 25% to 50%.
- *Which countries should we focus on over others?*
  Four out of the five countries experiencing the largest percentage decreases in forest cover are in Sub-Saharan Africa. During the period from 1990 to 2016, Togo saw over a 75% reduction in its forests. Other countries with significant losses include Nigeria (61.80%), Uganda (59.13%), and Mauritania (46.75%). It is crucial to recognize that our current lifestyle contributes to an unsustainable ecological footprint. Several measures can be implemented to mitigate this impact. First, reducing consumption can directly slow down the rate of deforestation. Second, avoiding products containing palm oil, which is a major driver of deforestation, particularly in Asia. Lastly, opting for sustainably certified products can promote environmentally responsible practices.

5. APPENDIX: SQL Queries Used

```sql
-- create view data
CREATE VIEW view_forestation AS
SELECT
 fa.country_code,
 fa.country_name,
 fa.year,
 fa.forest_area_sqkm,
 la.total_area_sq_mi,
 la.total_area_sq_mi * 2.59 AS total_area_sqkm,
 re.region,
 re.income_group,
```

```sql
 (fa.forest_area_sqkm / (la.total_area_sq_mi * 2.59)) * 100 AS
percent_forestation
FROM
 forest_area fa
JOIN
 land_area la ON fa.country_code = la.country_code AND fa.year = la.year
JOIN
 regions re ON re.country_code = fa.country_code;

-- GLOBAL SITUATION

SELECT year, SUM(forest_area_sqkm) AS total_forest_area
FROM view_forestation
WHERE year IN (1990, 2016)AND region = 'World'
GROUP BY year;

WITH ForestData AS (
   SELECT
       year,
       SUM(forest_area_sqkm) AS total_forest_area
   FROM
       view_forestation
   WHERE
       year IN (1990, 2016)
       AND region = 'World'
   GROUP BY
       year
)
SELECT
   fa1990.total_forest_area AS forest_area_1990,
   fa2016.total_forest_area AS forest_area_2016,
   (fa1990.total_forest_area - fa2016.total_forest_area) AS
forest_area_difference,
   ((fa1990.total_forest_area - fa2016.total_forest_area) /
fa1990.total_forest_area) * 100 AS percent_change
FROM
   ForestData fa1990,
```

```
   ForestData fa2016
WHERE
   fa1990.year = 1990
   AND fa2016.year = 2016;

SELECT
   country_name,
   ( total_area_sq_mi * 2.59 ) AS total_area_sqkm
FROM
   view_forestation
WHERE
   year = 2016
ORDER BY
   total_area_sqkm;

-- 2. REGIONAL OUTLOOK

SELECT
   percent_forestation
FROM
   view_forestation
WHERE
   year = 2016
   AND country_name = 'World';


SELECT
   percent_forestation
FROM
   view_forestation
WHERE
   year = 1990
   AND country_name = 'World';


WITH ForestationData AS (
   SELECT
```

```
        year,
        region,
        SUM(forest_area_sqkm) AS total_forest_area,
        SUM(total_area_sqkm) AS total_land_area,
        (SUM(forest_area_sqkm) / SUM(total_area_sqkm)) * 100 AS
percent_forestation
    FROM
        view_forestation
    WHERE
        year IN (1990, 2016)
    GROUP BY
        year, region
)
SELECT
    year,
    region,
    total_forest_area,
    total_land_area,
    percent_forestation
FROM
    ForestationData;

WITH ForestationData AS (
    SELECT
        year,
        region,
        SUM(forest_area_sqkm) AS total_forest_area,
        SUM(total_area_sqkm) AS total_land_area,
        (SUM(forest_area_sqkm) / SUM(total_area_sqkm)) * 100 AS
percent_forestation
    FROM
        view_forestation
    WHERE
        year IN (1990, 2016)
    GROUP BY
        year, region
)
```

```sql
-- Highest forestation in 1990 and 2016
SELECT
   year,
   region,
   percent_forestation
FROM
   ForestationData
WHERE
   year IN (1990, 2016)
ORDER BY
   year,
   percent_forestation DESC;

-- Lowest forestation in 1990 and 2016

WITH ForestationData AS (
   SELECT
       year,
       region,
       SUM(forest_area_sqkm) AS total_forest_area,
       SUM(total_area_sqkm) AS total_land_area,
       (SUM(forest_area_sqkm) / SUM(total_area_sqkm)) * 100 AS
percent_forestation
   FROM
       view_forestation
   WHERE
       year IN (1990, 2016)
   GROUP BY
       year, region
)
SELECT
   year,
   region,
   percent_forestation
FROM
   ForestationData
WHERE
```

```
   year IN (1990, 2016)
ORDER BY
   year,
   percent_forestation ASC;

-- 3. COUNTRY-LEVEL DETAIL

WITH ForestAreaChange AS (
   SELECT
       fa1990.country_name,
       fa1990.forest_area_sqkm AS forest_area_1990,
       fa2016.forest_area_sqkm AS forest_area_2016,
       (fa2016.forest_area_sqkm - fa1990.forest_area_sqkm) AS
forest_area_change
   FROM
       view_forestation fa1990
   JOIN
       view_forestation fa2016 ON fa1990.country_code =
fa2016.country_code
   WHERE
       fa1990.year = 1990 AND fa2016.year = 2016
)
SELECT
   country_name,
   forest_area_change
FROM
   ForestAreaChange
WHERE
   forest_area_change > 0
ORDER BY
   forest_area_change DESC
LIMIT 2;



SELECT
   curr.country_name,
```

```
   100.0 * (curr.forest_area_sqkm - prev.forest_area_sqkm) /
prev.forest_area_sqkm AS percentage_increase
FROM
   forest_area AS curr
JOIN
   forest_area AS prev ON curr.country_code = prev.country_code
                       AND curr.year = 2016
                       AND prev.year = 1990
WHERE
   curr.forest_area_sqkm > prev.forest_area_sqkm -- Ensures only positive
increases are calculated
ORDER BY
   percentage_increase DESC;

-- Table 3.1: Top 5 Amount Decrease in Forest Area by Country, 1990 &
2016:

SELECT
   curr.country_name,
   r.region,
   curr.forest_area_sqkm - prev.forest_area_sqkm AS difference
FROM
   forest_area AS curr
JOIN forest_area as prev ON ( curr.year = '2016'
                                    AND prev.year = '1990' )
                                  AND curr.country_name =
prev.country_name
JOIN regions as r ON r.country_code = curr.country_code
WHERE prev.country_name != 'World'
ORDER
   by difference limit 5;

-- The second way to consider which countries are of concern is to analyze
the data by percent decrease.

SELECT
   curr.country_name,
```

```
   r.region,
   100.0 * ( curr.forest_area_sqkm - prev.forest_area_sqkm ) /
prev.forest_area_sqkm AS percentage
FROM
   forest_area AS curr
JOIN forest_area as prev ON ( curr.year = '2016'
                                    AND prev.year = '1990' )
                                  AND curr.country_name =
prev.country_name
JOIN regions as r ON r.country_code = curr.country_code
ORDER
   by percentage limit 5;

SELECT
   quartiles,
   COUNT(*) AS count
FROM (
   SELECT
       country_name,
       CASE
           WHEN percent_forestation <= 25 THEN '0-25%'
           WHEN percent_forestation <= 50 THEN '25%-50%'
           WHEN percent_forestation <= 75 THEN '50%-75%'
           ELSE '75%-100%'
       END AS quartiles
   FROM
       view_forestation
   WHERE
       percent_forestation IS NOT NULL
       AND year = 2016
) AS sub
GROUP BY
   quartiles;


SELECT
   v.country_name,
```

```
   r.region,
   v.percent_forestation
FROM
   view_forestation v
   JOIN regions r on r.country_code = v.country_code
WHERE
   v.percent_forestation > 75
   AND year = 2016;
```