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 3.2 %.

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 1279999.9891 km2).

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

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 (dropped from 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, is China. This country actually increased in forest area from 1990 to 2016 by 527229.06 km2. 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 km2, much lower than the figure for China.

The United States 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'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	541,510.00 km2
Indonesia	East Asia & Pacific	282,193.98 km2
Myanmar	East Asia & Pacific	107,234.00 km2
Nigeria	Sub-Saharan Africa	106,506.00 km2
Tanzania	Sub-Saharan Africa	102,320.00 km2

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	61.8%
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 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	72
50-75	38
75-100	9

The largest number of countries in 2016 were found in the 1st quartile (0-25%).

There were nine 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	87.5%
Guyana	Latin America & Caribbean	83.9%
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?*
- *Which countries should we focus on over others?*

After reviewing the analysis of the data and information about the deforestation in the world between 1990 - 2016 we can observe that the quantity of forest area in the world has decreased 3.2% in the world, this means a loss of 1,324,449 km2. Also there are good news because in some countries and regions there has been an increase in forest area and forest percentage. In fact the only 2 regions that have decreased in this time are Latin America & Caribbean and Sub-Saharan Africa. So we need to start doing a change because the quality and the life in the areas where the forest has decreased could be affected and decrease even more in the near future.

So my proposal is to look for the countries and areas that in the last past years have been increasing their forest area and forest percentage and see what kind of activities they are implementing to increase these metrics and also start the changes to increase the forest area and percentage in the main countries with the largest absolute forest change.
We can observe the main countries in section number 3.

In this way and if everything starts going better we can have in the near future an increase in the world forest area and percentage.

5. APPENDIX: SQL Queries Used

```
- - Create view to work in a virtual environment

DROP VIEW IF EXISTS forestation;

CREATE VIEW forestation
AS
  (SELECT f.country_code,
          f.country_name                                  AS
            f_country_name,
          f.year                                       AS f_year
          ,
          f.forest_area_sqkm,
          l.country_name                                  AS
            l_country_name,
          l.year,
          ( l.total_area_sq_mi * 2.59 )                      AS
            total_area_sqkm,
          ( f.forest_area_sqkm / ( l.total_area_sq_mi * 2.59 ) ) * 100 AS
          percentage_forest_p_a,
          r.country_name,
          r.region,
          r.income_group
   FROM   forest_area f
          LEFT JOIN land_area l
                 ON l.country_code = f.country_code
                    AND l.year = f.year
          LEFT JOIN regions r
                 ON r.country_code = f.country_code);


- - Total forest area in 1990
           SELECT SUM(forest_area_sqkm) total_forest_area
           FROM   forestation
           WHERE  year = 1990
           AND    country_name LIKE 'World’
- - Total forest area in 2016
           SELECT SUM(forest_area_sqkm) total_forest_area
           FROM forestation
           WHERE YEAR = 2016
            AND country_name LIKE 'World'
```

```
- - Change in sq km2 from 1990 to 2016
SELECT ( (SELECT Sum(forest_area_sqkm) total_forest_area
         FROM   forestation
         WHERE  year = 1990
                AND country_name LIKE 'World') - (SELECT
                Sum(forest_area_sqkm) total_forest_area
                                      FROM   forestation
                                      WHERE  year = 2016
                                             AND country_name LIKE
                                                 'World'
                                     ) ) AS difference_area
FROM   forestation
LIMIT  1
 - - percent change in forest area of the world from 1990 to 2016
SELECT ( ( ( (SELECT Sum(forest_area_sqkm) total_forest_area
             FROM   forestation
             WHERE  year = 1990
                    AND country_name LIKE 'World') - (SELECT
                      Sum(forest_area_sqkm) total_forest_area
                                        FROM   forestation
                                        WHERE  year = 2016
                                               AND country_name
                                                   LIKE
                                                   'World'
                                       ) ) /
         ((SELECT
                Sum(forest_area_sqkm) total_forest_area
                                        FROM   forestation
                                        WHERE  year = 1990
                                               AND
         country_name
         LIKE
         'World'
         )) ) *
             100 ) AS percent_decrease
FROM   forestation
LIMIT  1

 - - which country's total area in 2016 is it closest to?

ELECT country_name,
       Sum(total_area_sqkm) AS total_land_area
```

```
FROM   forestation
WHERE  year = 2016
       AND total_area_sqkm <= 1324449.00
GROUP  BY country_name,
          total_area_sqkm
ORDER  BY total_land_area DESC
LIMIT  1
```

2. - - What was the percent forest of the entire world in 2016?

```
SELECT country_name,
      Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sqkm) ) * 100 ) ::
           NUMERIC, 2)
      AS percent_forest
FROM   forestation
WHERE  year = 2016
      AND country_name LIKE 'World'
GROUP  BY country_name
```

- - What was the percent forest of the entire world in 1990?

```
SELECT country_name,
      Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sqkm) ) * 100 ) ::
           NUMERIC, 2)
      AS percent_forest
FROM   forestation
WHERE  year = 1990
      AND country_name LIKE 'World'
GROUP  BY country_name
```

- - Which region had the HIGHEST percent forest in 2016, and which had the LOWEST, to 2 decimal places?

```
SELECT region,
      Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sqkm) ) * 100 ) ::
           NUMERIC, 2)
      AS percent_forest
FROM   forestation
WHERE  year = 2016
GROUP  BY region
ORDER  BY percent_forest DESC
```

- - Which region had the HIGHEST percent forest in 1990, and which had the LOWEST, to 2 decimal places?

```
SELECT region,
      Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sqkm) ) * 100 ) ::
           NUMERIC, 2)
      AS percent_forest
```

```
FROM   forestation
WHERE  year = 1990
GROUP  BY region
ORDER  BY percent_forest DESC
```

- - Based on the table you created, which regions of the world DECREASED in forest area from 1990 to 2016?

Table2.1

1990

```
SELECT region,
      Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sqkm) ) * 100 ) ::
           NUMERIC, 2)
      AS percent_forest
FROM   forestation
WHERE  year = 1990
GROUP  BY region
ORDER  BY percent_forest DESC
```

2016

```
SELECT region,
      Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sqkm) ) * 100 ) ::
           NUMERIC, 2)
      AS percent_forest
FROM   forestation
WHERE  year = 2016
GROUP  BY region
ORDER  BY percent_forest DESC
```

3 - -Which 5 countries saw the largest amount decrease in forest area from 1990 to 2016?

```
WITH t1 AS
(
	SELECT	country_name,
		Sum(forest_area_sqkm) forest_area_1
	FROM	forestation
	WHERE	year = 1990
	GROUP BY country_name,
		forest_area_sqkm), t2 AS
(
	SELECT	country_name,
		Sum(forest_area_sqkm) forest_area_2
	FROM	forestation
	WHERE	year = 2016
	GROUP BY country_name,
		forest_area_sqkm)
SELECT	f.country_name,
	 (f.forest_area_1 - t.forest_area_2) forest_change
FROM	t1 f
LEFT JOIN t2 t
ON	f.country_name = t.country_name
ORDER BY  forest_change
LIMIT 2
```

- - Country that increased their forest area between 1990-2016 and how much %?

```
WITH t1 AS
(
	SELECT	country_name,
		(Sum(forest_area_sqkm) / Sum(total_area_sqkm))*100
percent_forestation_1
	FROM	forestation
	WHERE	year = 1990
	GROUP BY country_name,
		forest_area_sqkm), t2 AS
(
	SELECT	country_name,
```

```
            (Sum(forest_area_sqkm) / Sum(total_area_sqkm))*100
percent_forestation_2
        FROM     forestation
        WHERE    year = 2016
        GROUP BY country_name,
                 forest_area_sqkm)
SELECT     f.country_name,
           Round((((f.percent_forestation_1 -
t.percent_forestation_2)/(f.percent_forestation_1))*100)::numeric, 2) percent_change
FROM       t1 f
- - Here we have an inner join
INNER JOIN t2 t
ON         f.country_name = t.country_name
ORDER BY   percent_change
LIMIT 1


- - Which 5 countries saw the largest percent decrease in forest area from 1990 to
2016?
WITH t1 AS
(
        SELECT   country_name,
                 (Sum(forest_area_sqkm) / Sum(total_area_sqkm))*100 percent_forestation_1
        FROM     forestation
        WHERE    year = 1990
        GROUP BY country_name,
                 forest_area_sqkm), t2 AS
(
        SELECT   country_name,
                 (Sum(forest_area_sqkm) / Sum(total_area_sqkm))*100 percent_forestation_2
        FROM     forestation
        WHERE    year = 2016
        GROUP BY country_name,
                 forest_area_sqkm)
SELECT     f.country_name,
           Round((((f.percent_forestation_1 -
t.percent_forestation_2)/(f.percent_forestation_1))*100)::numeric, 2) percent_change
FROM       t1 f
- - Here we have an inner join
INNER JOIN t2 t
ON         f.country_name = t.country_name
```

```
WHERE      f.percent_forestation_1 IS NOT NULL
AND        t.percent_forestation_2 IS NOT NULL
AND        f.country_name != 'World'
ORDER BY   percent_change DESC
LIMIT 5

- - Country classification by quartiles (Q1-Q4)
WITH t1
    AS (SELECT country_name,
               year,
               ( Sum(forest_area_sqkm) / Sum(total_area_sqkm) ) * 100
                 percent_forestation
        FROM   forestation
        WHERE  year = 2016
        GROUP  BY country_name,
                  year,
                  forest_area_sqkm)
SELECT DISTINCT( quartiles ),
               Count(country_name)
                 OVER(
                   partition BY quartiles)
FROM   (SELECT country_name,
               CASE
                 WHEN percent_forestation < 25 THEN '0-25'
                 WHEN percent_forestation >= 25
                      AND percent_forestation < 50 THEN '25-50'
                 WHEN percent_forestation >= 50
                      AND percent_forestation < 75 THEN '50-75'
                 ELSE '75-100'
               END AS quartiles
       FROM   t1
       WHERE  percent_forestation IS NOT NULL
              AND year = 2016) AS qa


 - - List all of the countries that were in the 4th quartile (percent forest > 75%) in 2016.
WITH t2
    AS (WITH t1
               AS (SELECT country_name,
                          year,
                          ( SUM(forest_area_sqkm) / SUM(total_area_sqkm) ) * 100
                            percent_forestation
```

```
            FROM   forestation
            WHERE  year = 2016
            GROUP  BY country_name,
                      year,
                      forest_area_sqkm)
        SELECT DISTINCT( quartiles ),
                    Count(country_name)
                     over(
                       PARTITION BY quartiles),
                    country_name,
                    percent_forestation
         FROM   (SELECT country_name,
                     percent_forestation,
                     CASE
                       WHEN percent_forestation <= 25 THEN '0-25'
                       WHEN percent_forestation > 25
                            AND percent_forestation <= 50 THEN '25-50'
                       WHEN percent_forestation > 50
                            AND percent_forestation <= 75 THEN '50-75'
                       ELSE '75-100'
                     END AS quartiles
                FROM   t1
                WHERE  percent_forestation IS NOT NULL
                     AND year = 2016) sub)
SELECT country_name,
       quartiles,
       Round(percent_forestation :: NUMERIC, 2) percent_forestation
FROM   t2
WHERE  quartiles = '75-100'
ORDER  BY percent_forestation DESC
```