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 **3.21%.**

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 sq.km).

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-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 **527229.06 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 **79200.00**, much lower than the figure for **448029.06 sq km**.

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	541510.00
Indonesia	East Asia & Pacific	282193.98
Myanmar	East Asia & Pacific	107234.00
Nigeria	Sub-Saharan Africa	106506.00
Tanzania	Sub-Saharan Africa	102320.00

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	-59.13
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
Q1	**85**
Q2	**72**
Q3	**38**
Q4	**9**

The largest number of countries in 2016 were found in the **1th** 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 Forest Query team.

- *What have you learned from the World Bank data?*
  Overall, world has lost around 3.21% of forest, which accounts to a loss of 1324449 sq.km of forest or deforestation**,** *in 26 years, from 1990 to 2016. It is a major concern for the world and also is the main reason for ozone depletion resulting in Global warming. Apart from that, natural habitants are also losing their shelter and being endangered slowly.*

- *Which countries should we focus on over others?*
  Some of the countries like Brazil, Indonesia, Myanmar, etc. should be focused more than any other countries in the world as those nation is among the top deforesting countries around the globe. If we look on the basis of region, Sub-Saharan Africa region is the major concern of all as 4 countries among top 5 to lose most percentage of forest land comes from these regions.

  Those countries should learn from country like Iceland who increased its land area significantly by around 213%.

5. APPENDIX: SQL Queries Used

-- CREATING FORESTATION VIRTUAL TABLE

```
DROP VIEW IF EXISTS forestation;
CREATE VIEW forestation AS
        (SELECT     f.country_code,
                    f.country_name,
                    f.year,
                    f.forest_area_sqkm,
                    l.total_area_sq_mi,
                    r.region,
                    r.income_group,
                    l.total_area_sq_mi * 2.59 total_area_sqkm,
                    ROUND(((f.forest_area_sqkm/(l.total_area_sq_mi*2.59))*100)::numeric,2)
                percentage_forest_area
```

```
        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);
```

---- TASK 1: GLOBAL SITUATION

```
WITH forest_area_1990 as
        (SELECT       country_name,
                      year,
                      forest_area_sqkm
        FROM forestation
        WHERE country_name='World' AND year=1990),
forest_area_2016 as
        (SELECT       country_name,
                      year, forest_area_sqkm
        FROM forestation
        WHERE country_name='World' AND year=2016)

SELECT *
FROM forest_area_2016;
```

-- difference between 1990 and 2016

```
SELECT
        (SELECT forest_area_sqkm
         FROM forestation
        WHERE country_name='World' AND year=1990)-
        (SELECT forest_area_sqkm
        FROM forestation
        WHERE country_name='World' AND year=2016) as difference;
```

-- percentage change from 1990 to 2016

```
WITH forest_area_1990 as
        (SELECT       country_name,
                      year, forest_area_sqkm
        FROM forestation
        WHERE country_name='World' AND year=1990),

forest_area_2016 as
        (SELECT       country_name,
```

```
                year, forest_area_sqkm
        FROM forestation
        WHERE country_name='World' AND year=2016),

diff AS
        (SELECT     f90.forest_area_sqkm a_1990,
                    f16.forest_area_sqkm a_2016,
                    (f90.forest_area_sqkm - f16.forest_area_sqkm) diff,
                    ((f90.forest_area_sqkm - f16.forest_area_sqkm)/
                    f90.forest_area_sqkm)*100 percentage_diff
        FROM forest_area_1990 f90, forest_area_2016 f16)

SELECT a_1990,a_2016,diff, ROUND(percentage_diff::numeric,2)
FROM diff;
```

--camparing area lost with entire country of that area

```
SELECT      country_name,
            ROUND(total_area_sqkm::numeric,2) total_area_sqkm
FROM forestation
WHERE (total_area_sqkm BETWEEN 1270000 AND 1350000) AND year=2016;
```

-- TASK 2: REGIONAL OUTLOOK

```
WITH forest_percentage_1990 as
        (Select     region,
                    ROUND ((SUM (forest_area_sqkm)*100/
                    SUM(total_area_sqkm))::numeric,2) percent_1990
        FROM forestation
        WHERE year=1990
        GROUP BY region
        ORDER BY percent_1990 DESC),

forest_percentage_2016 as
        (Select     region,
                    ROUND ((SUM (forest_area_sqkm)*100/
                    SUM(total_area_sqkm))::numeric,2) percent_2016
        FROM forestation
        WHERE year=2016
        GROUP BY region
        ORDER BY percent_2016 DESC),

joined_1990_2016 as
```

```
        (Select         fp1990.region,
                        fp1990.percent_1990,
                        fp2016.percent_2016
        FROM forest_percentage_1990 fp1990
        JOIN forest_percentage_2016 fp2016
        ON fp1990.region=fp2016.region)

Select *
FROM joined_1990_2016;
```

TASK 3- COUNTRY-LEVEL DETAIL

```
--Success story
WITH Forest_area_1990 AS
        (SELECT country_name,
                year,
                forest_area_sqkm,
                region
        FROM forestation
        WHERE year=1990 AND forest_area_sqkm IS NOT NULL),

Forest_area_2016 AS
        (SELECT country_name,year,forest_area_sqkm,region
        FROM forestation
        WHERE year=2016 AND forest_area_sqkm IS NOT NULL),
Difference_forest_area AS
        (SELECT FA90.country_name,
                FA16.region, FA90.year year_1990,
                FA16.year year_2016 ,
                FA90.forest_area_sqkm AREA_1990,
                FA16.forest_area_sqkm AREA_2016,
                (FA16.forest_area_sqkm-FA90.forest_area_sqkm) Diff,
                ((FA16.forest_area_sqkm-
        FA90.forest_area_sqkm)*100/FA90.forest_area_sqkm) per_decrease_forest_area
        FROM forest_area_1990 FA90
        JOIN forest_area_2016 FA16
        ON FA90.country_name=FA16.country_name
        ORDER BY Diff desc)

SELECT df.country_name,
                df.region,ROUND(df.diff::numeric,2) as Change_in_forest_area,
                ROUND(df.per_decrease_forest_area::numeric,2) per_decrease_forest_area
FROM Difference_forest_area df
```

```
ORDER BY per_decrease_forest_area DESC
 LIMIT 6;
```

--- top 5 countries with largest amount decrease in forest area and difference in forest area for each

```
WITH Forest_area_1990 AS
        (SELECT country_name,
                year,
                forest_area_sqkm,
                region
        FROM forestation
        WHERE year=1990 AND forest_area_sqkm IS NOT NULL),

Forest_area_2016 AS
        (SELECT country_name,year,forest_area_sqkm,region
        FROM forestation
        WHERE year=2016 AND forest_area_sqkm IS NOT NULL),
Difference_forest_area AS
        (SELECT FA90.country_name,
                FA16.region, FA90.year year_1990,
                FA16.year year_2016 ,
                FA90.forest_area_sqkm AREA_1990,
                FA16.forest_area_sqkm AREA_2016,
                (FA90.forest_area_sqkm-FA16.forest_area_sqkm) Diff,
        FROM forest_area_1990 FA90
        JOIN forest_area_2016 FA16
        ON FA90.country_name=FA16.country_name
        ORDER BY Diff )

SELECT df.country_name,
                df.region,df.area_1990,df.area_2016,ROUND(df.diff::numeric,2) as
        Change_in_forest_area,
FROM Difference_forest_area df
LIMIT 6;
```

--- 5 countries saw the largest percent decrease in forest area from 1990 to 2016? What was the percent change to 2 decimal places for each

```
 WITH Forest_area_1990 AS
        (SELECT         country_name,
```

```
                year,
                forest_area_sqkm,region,
                total_area_sqkm
        FROM forestation
        WHERE year=1990 AND forest_area_sqkm IS NOT NULL),

  Forest_area_2016 AS
        (SELECT country_name,
                year,
                forest_area_sqkm,region,
                total_area_sqkm
        FROM forestation
        WHERE year=2016 AND forest_area_sqkm IS NOT NULL),
Difference_forest_area AS
        (SELECT FA90.country_name,
                FA16.region,
                FA90.year year_1990,
                FA16.year year_2016 ,
                FA90.total_area_sqkm totalarea1990,
                FA16.total_area_sqkm totalarea2016,
                FA90.forest_area_sqkm AREA_1990,
                FA16.forest_area_sqkm AREA_2016,
                (FA16.forest_area_sqkm-FA90.forest_area_sqkm) Diff,
                ((FA16.forest_area_sqkm-FA90.forest_area_sqkm)*100/
            FA90.forest_area_sqkm) per_decrease_forest_area
        FROM forest_area_1990 FA90
        JOIN forest_area_2016 FA16
        ON FA90.country_name=FA16.country_name
        ORDER BY Diff)

SELECT      df.country_name,
            df.region,
            ROUND(df.per_decrease_forest_area::numeric,2) per_dec_forest_area
FROM Difference_forest_area df
ORDER BY per_dec_forest_area
LIMIT 5;
```

--- If countries were grouped by percent forestation in quartiles, which group had the most countries in it in 2016

```
WITH forest_percentage AS
                (SELECT country_name,percentage_forest_area
                FROM forestation
                WHERE year=2016 AND percentage_forest_area IS NOT NULL),

 T1 AS
                (SELECT fp.country_name, fp.percentage_forest_area,
                        CASE
                                WHEN fp.percentage_forest_area>=75 THEN 'Q4'
                                WHEN fp.percentage_forest_area>=50 THEN 'Q3'
                                WHEN fp.percentage_forest_area>=25 THEN 'Q2'
                                ELSE 'Q1'
                                END AS Quartiles
                FROM forest_percentage fp
                WHERE percentage_forest_area IS NOT NULL AND country_name!='World')

  SELECT Quartiles, count(*)
  FROM T1
  GROUP BY 1
  ORDER BY 1;
```

--List all of the countries that were in the 4th quartile (percent forest > 75%) in 2016.

```
WITH forest_percentage AS
                (SELECT     country_name,
                            percentage_forest_area,
                            region
                FROM forestation
                 WHERE year=2016 AND percentage_forest_area IS NOT NULL),

 T1 AS
                (SELECT     fp.country_name,
                            fp.region,
                            fp.percentage_forest_area,
                                    CASE
```

```
                    WHEN fp.percentage_forest_area>=75 THEN 'Q4'
                    WHEN fp.percentage_forest_area>=50 THEN 'Q3'
                    WHEN fp.percentage_forest_area>=25 THEN 'Q2'
                    ELSE 'Q1'
                    END AS Quartiles
            FROM forest_percentage fp
            WHERE percentage_forest_area IS NOT NULL AND country_name!='World')

SELECT Country_name,region,percentage_forest_area
FROM T1
WHERE Quartiles='Q4'
ORDER BY 3 DESC;
```