SQL Project

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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 $41,282,694.9km^2$ in 1990. As of 2016, the most recent year for which data was available, that number had fallen to $39,958,245.9km^2$, a loss of $1,324,449km^2$, or 3.21%.

The forest area lost over this time period $(511,370.27mi^2)$ is slightly more than the entire land area of Peru listed for the year 2016 (which is $492,208.49m^2$).

2. **Regional Outlook**

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.

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.

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
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
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 (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 $527,229.06km^2$. 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 $79,200.00km^2$, much lower than the figure for China.

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 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

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 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.

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**

- What have you learned from the World Bank data?

  The area of forest has decreased in the last 20 years, due to the lost in Latin America & Caribbean and Sub-Saharan Africa. However, in most cases, the area of forest has actually increased or stayed the same.
  When we look at counties independently, there was a significant decrease in countries such as Brazil, Indonesia, Myanmar, and Nigeria in absolute number. In percentages, we can conclude that counties in Sub-Saharan Africa suffer the most due to the deforestation.
  According to the table 3.3, a number of countries don't have the forestation rate which is higher than 75% That leads us to the conclusion that only 9 countries on earth have the forestation rate of more than 75% as of 2016.

- Which countries should we focus on over others?

  In general, counties that are present in table 3.1 and 3.2 should take an immediate action to tackle this problem. No only a large amount of lost forest area can be a problem but a relatively higher percentage within the region can be devastating, as this indicates the unavailability of integral agricultural activities. Especially Nigeria, that is present both on the table 3.1 and 3.2.

SQL Queries Used

CREATE VIEW forestation

```
CREATE VIEW forestation AS
SELECT      f.country_code,
            f.country_name,
            f.year,
            forest_area_sqkm,
            total_area_sq_mi,
            region,
            income_group,
            (forest_area_sqkm / (total_area_sq_mi * 2.59)) * 100
            AS percent_designated_forest
FROM        forest_area AS f
JOIN        land_area AS l
ON          f.country_code = l.country_code
AND         f.year = l.year
JOIN        regions AS r
ON          f.country_code = r.country_code
```

Global Situation

```
WITH t1 AS(SELECT *
FROM forestation
WHERE year = 1990
AND country_name = 'World'),

t2 AS(SELECT *
FROM forestation
WHERE year = 2016
AND country_name = 'World')

SELECT t1.country_name,
       t1.forest_area_sqkm AS forest_1990,
       t2.forest_area_sqkm AS forest_2016,
       t1.forest_area_sqkm - t2.forest_area_sqkm AS lost_forest_area,
       (t1.forest_area_sqkm - t2.forest_area_sqkm) / 2.59 AS lost_forest_area_sq_mi,
       ROUND((((t1.forest_area_sqkm - t2.forest_area_sqkm) / t1.forest_area_sqkm) * 100)::numeric, 2) AS lost_forea_area_percentage

FROM t1
JOIN t2
ON t1.country_name = t2.country_name;
```

```
SELECT   country_name,
         total_area_sq_mi
FROM     forestation
WHERE    total_area_sq_mi > 490000
AND      year = 2016
ORDER BY total_area_sq_mi
LIMIT    1;
```

Regional Outlook

```
WITH t1 AS (
  SELECT   region,
           ROUND((SUM(forest_area_sqkm) / (SUM(total_area_sq_mi) * 2.59) * 100)::numeric, 2) AS forest_1990
  FROM     forestation
  WHERE    year = 1990
  GROUP BY region
  ORDER BY forest_1990 DESC
),
t2 AS (
  SELECT   region,
           ROUND((SUM(forest_area_sqkm) / (SUM(total_area_sq_mi) * 2.59) * 100)::numeric, 2) AS forest_2016
  FROM     forestation
  WHERE    year = 2016
  GROUP BY region
  ORDER BY forest_2016 DESC
)

SELECT     *
FROM       t1
JOIN       t2
ON         t1.region = t2.region;
```

Country-Level Detail

3A

```
WITH t1 AS (
  SELECT country_name,
         forest_area_sqkm
  FROM   forestation
  WHERE  year = 1990
  AND    country_name != 'World'
),

t2 AS (
  SELECT country_name,
         forest_area_sqkm
  FROM   forestation
  WHERE  year = 2016
  AND    country_name != 'World'
)

SELECT   t1.country_name,
         t1.forest_area_sqkm AS forest_area_1990,
         t2.forest_area_sqkm AS forest_area_2016,
         ROUND((t2.forest_area_sqkm - t1.forest_area_sqkm)::numeric, 2)
         AS forest_area_diff
FROM     t1
JOIN     t2
ON       t1.country_name = t2.country_name
WHERE    t2.forest_area_sqkm - t1.forest_area_sqkm IS NOT NULL
GROUP BY 1, 2, 3
ORDER BY forest_area_diff DESC;
```

3B

```
WITH t1 AS (
  SELECT country_name,
         region,
         forest_area_sqkm
  FROM   forestation
  WHERE  year = 1990
  AND    country_name != 'World'
),

t2 AS (
  SELECT country_name,
         region,
         forest_area_sqkm
  FROM   forestation
  WHERE  year = 2016
  AND    country_name != 'World'
)

SELECT   t1.country_name,
         t1.region,
         ROUND((t2.forest_area_sqkm - t1.forest_area_sqkm)::numeric, 2)
         AS absolute_forest_area_change
FROM     t1
JOIN     t2
ON       t1.country_name = t2.country_name
WHERE    t2.forest_area_sqkm - t1.forest_area_sqkm IS NOT NULL
GROUP BY 1, 2, 3
ORDER BY absolute_forest_area_change;
```

```
WITH t1 AS (
  SELECT country_name,
         region,
         forest_area_sqkm
  FROM   forestation
  WHERE  year = 1990
  AND    country_name != 'World'
),

t2 AS (
```

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

SELECT   t1.country_name,
         t1.region,
         ROUND((((t2.forest_area_sqkm - t1.forest_area_sqkm)/(t1.forest_area_sqkm)) * 100)::numeric, 2)
         AS prc_forest_area_change
FROM     t1
JOIN     t2
ON       t1.country_name = t2.country_name
WHERE    t2.forest_area_sqkm - t1.forest_area_sqkm IS NOT NULL
GROUP BY 1, 2, 3
ORDER BY prc_forest_area_change;
```

3C

```
SELECT COUNT(CASE WHEN percent_designated_forest >= 75
       AND percent_designated_forest <= 100 THEN 1 ELSE NULL END) AS first,
       COUNT(CASE WHEN percent_designated_forest >= 50
       AND percent_designated_forest < 75 THEN 1 ELSE NULL END) AS second,
       COUNT(CASE WHEN percent_designated_forest >= 25
       AND percent_designated_forest < 50 THEN 1 ELSE NULL END) AS third,
       COUNT(CASE WHEN percent_designated_forest < 25 THEN 1 ELSE NULL END) AS fourth
FROM   forestation
WHERE  year = 2016
AND    country_name != 'World';
```

```
SELECT   country_name,
         region,
         ROUND(percent_designated_forest::numeric, 2)
FROM     forestation
WHERE    country_name != 'World'
AND      year = 2016
AND      percent_designated_forest >= 75
ORDER BY percent_designated_forest DESC;
```