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 sqkm** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9 sqkm**, a loss of **1324449 sqkm**, or **3.20824258980244%**.

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 sqkm**).

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
World	32.42	31.38
Sub-Saharan Africa	30.67	28.79
Europe & Central Asia	37.28	38.04
North America	35.65	36.04
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 **527229.062 sqkm**. 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 sqkm**, 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	541510.00000
Indonesia	East Asia & Pacific	282193.98440
Myanmar	East Asia & Pacific	107234.00390
Nigeria	Sub-Saharan Africa	106506.00098
Tanzania	Sub-Saharan Africa	102320.00000

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	59.27
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

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 **0 – 25%** quartile.

There were **85** 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	77.8635177945066
Suriname	Latin America & Caribbean	98.2576939676578
Seychelles	Sub-Saharan Africa	88.4111367385789

5. RECOMMENDATIONS

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

According to the result, I would recommend more awareness about the benefits of forestation and the danger with deforestation should be towards the Sub-Sahara Africa region.

- *What have you learned from the World Bank data?*

I learnt that there was decrease in forestation from 1990 to 2016 with 1,324,449 km^2 and it require actions to be taken to avoid further decrease in forestation.

- *Which countries should we focus on over others?*

More focus should be on the countries in Sub-Sahara Africa region as well as other countries too because all countries.

APPENDIX

--View creation

```
CREATE VIEW forestation
AS
  (SELECT f.country_code,
          f.country_name,
          f.year,
          f.forest_area_sqkm,
          l.total_area_sq_mi,
          ( forest_area_sqkm / ( total_area_sq_mi * 2.59 ) * 100 ) AS
             forest_percent,
          r.region,
          r.income_group
   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);
```

/*the total forest area (in sq km) of the world in 1990 and 2016*/

```
SELECT Sum(forest_area_sqkm)
FROM   forestation
WHERE  year = 1990
       AND region = 'World';

SELECT Sum(forest_area_sqkm)
FROM   forestation
WHERE  year = 2016
       AND region = 'World';
```

/*the change (in sq km) in the forest area of the world from 1990 to 2016*/

```
SELECT tab1.forest_area_sqkm - tab2.forest_area_sqkm AS forest_area_di
ff
FROM   (SELECT country_code,
               forest_area_sqkm
        FROM   forestation f
        WHERE  region = 'World'
               AND year = 1990) tab1
       JOIN(SELECT country_code,
                   forest_area_sqkm
            FROM   forestation f
            WHERE  region = 'World'
```

```
                    AND year = 2016) tab2
          ON tab1.country_code = tab2.country_code;
```

/*the percent change in forest area of the world between 1990 and 2016*/

```
SELECT ( ( tab1.forest_area_sqkm - tab2.forest_area_sqkm ) /
         tab1.forest_area_sqkm ) *
              100 AS forest_area_percent
FROM   (SELECT country_code,
               forest_area_sqkm
        FROM   forestation f
        WHERE  region = 'World'
               AND year = 1990) tab1
       JOIN(SELECT country_code,
                   forest_area_sqkm
            FROM   forestation f
            WHERE  region = 'World'
                   AND year = 2016) tab2
         ON tab1.country_code = tab2.country_code;
```

/*the amount of forest area lost between 1990 and 2016 compared to the country with closest total land area*/

```
SELECT country_name,
       total_area_sq_mi * 2.59 AS total_area_sqkm
FROM   forestation
WHERE  year = 2016
       AND total_area_sq_mi * 2.59 <= 1324449
GROUP  BY 1,
          2
ORDER  BY 2 DESC
LIMIT  1;
```

/*the percent forest of the entire world in 2016 with the region that had the HIGHEST and lowest percent forest in 2016*/

```
SELECT Round(( SUM(forest_area_sqkm) / SUM(total_area_sq_mi * 2.59) *
100 ) ::
             NUMERIC,
              2) AS percent_forest
FROM   forestation
WHERE  year = 2016
       AND region = 'World';

/*the percent forest of the entire world in 1990 with the region that
had the HIGHEST and lowest percent forest in 1990*/
SELECT Round(( SUM(forest_area_sqkm) / SUM(total_area_sq_mi * 2.59) *
100 ) ::
             NUMERIC,
              2) AS percent_forest
```

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


/*regions of the world that DECREASED in forest area from 1990 to
2016*/
SELECT region,
       Round(( SUM(forest_area_sqkm) / SUM(total_area_sq_mi * 2.59) *
100 ) ::
             NUMERIC,
       2) AS percent_forest
FROM   forestation
WHERE  year = 2016
GROUP  BY 1
ORDER  BY 2 DESC

SELECT region,
       Round(( SUM(forest_area_sqkm) / SUM(total_area_sq_mi * 2.59) *
100 ) ::
             NUMERIC,
       2) AS percent_forest
FROM   forestation
WHERE  year = 1990
GROUP  BY 1
ORDER  BY 2 DESC;
```

/*5 countries that saw the largest amount decrease in forest area from 1990 to 2016 with their differences*/

```
SELECT tb1.country_name,
       tb1.forest_1990,
       tb2.forest_2016,
       ( tb2.forest_2016 - tb1.forest_1990 ) forest_increase
FROM   (SELECT country_name,
               forest_area_sqkm AS forest_1990
        FROM   forestation
        WHERE  year = 1990
        GROUP  BY 1,
                  2) tb1
       JOIN (SELECT country_name,
                    forest_area_sqkm AS forest_2016
             FROM   forestation
             WHERE  year = 2016
             GROUP  BY 1,
```

```
                    2)tb2
        ON tb1.country_name = tb2.country_name
WHERE  tb2.forest_2016 > tb1.forest_1990
ORDER  BY 4 DESC
LIMIT  5;

/*5 countries that saw the largest percent decrease in forest area from 1990 to 2016*/
WITH tb_1990 AS
(
       SELECT country_code,
              country_name,
              year,
              forest_area_sqkm
       FROM   forestation f
       WHERE  f.year = 1990
       AND    f.forest_area_sqkm IS NOT NULL
       AND    f.country_name != 'World'), tb_2016 AS
(
       SELECT country_code,
              country_name,
              year,
              forest_area_sqkm
       FROM   forestation f
       WHERE  f.year = 2016
       AND    f.forest_area_sqkm IS NOT NULL
       AND    f.country_name != 'World')
SELECT   tb_1990.country_code,
         tb_2016.country_name,
         r.region,
         tb_1990.forest_area_sqkm                                AS forest
_area_1990,
         tb_2016.forest_area_sqkm                                AS forest
_area_2016,
         tb_1990.forest_area_sqkm - tb_2016.forest_area_sqkm AS forest
_area_diff
FROM     tb_1990
JOIN     tb_2016
ON       tb_1990.country_code = tb_2016.country_code
AND      (
                  tb_1990.forest_area_sqkm IS NOT NULL
         AND      tb_2016.forest_area_sqkm IS NOT NULL)
JOIN     regions r
ON       tb_2016.country_code = r.country_code
ORDER BY 6 DESC limit 5;
```

```
SELECT   tb1.country_name,
         tb1.region,
         tb1.forest_percent_1990,
         tb2.forest_percent_2016,
         Round(Cast(((tb1.forest_percent_1990 - tb2.forest_percent_201
6) / tb1.forest_percent_1990) * 100 AS NUMERIC),2) forest_percent_dec
FROM     (
                  SELECT   country_name,
                           region,
                           forest_percent AS forest_percent_1990
                  FROM     forestation
                  WHERE    year = 1990
                  AND      forest_area_sqkm IS NOT NULL
                  AND      total_area_sq_mi IS NOT NULL
                  GROUP BY 1,
                           2,
                           3) tb1
JOIN
         (
                  SELECT   country_name,
                           region,
                           forest_percent AS forest_percent_2016
                  FROM     forestation
                  WHERE    year = 2016
                  AND      forest_area_sqkm IS NOT NULL
                  AND      total_area_sq_mi IS NOT NULL
                  GROUP BY 1,
                           2,
                           3)tb2
ON       tb1.country_name = tb2.country_name
WHERE    tb1.forest_percent_1990 > tb2.forest_percent_2016
ORDER BY 5 DESC limit 5;

/*Countries grouped by percent forestation in quartiles*/
SELECT DISTINCT( quartiles ),
               Count(country_name)
                 OVER (
                   partition BY quartiles) AS country_count
FROM   (SELECT country_name,
               CASE
                 WHEN forest_percent <= 25 THEN '0-25%'
                 WHEN forest_percent > 25
                      AND forest_percent <= 50 THEN '25%-50%'
                 WHEN forest_percent > 50
                      AND forest_percent <= 75 THEN '50%-75%'
```

```
                ELSE '75%-100%'
              END AS quartiles
       FROM   forestation
       WHERE  year = 2016 AND region != 'World'
              AND forest_percent IS NOT NULL)Tb1;


/*list of all countries that were in the 4th quatile(percent
forest>75%) in 2016*/
SELECT country_name,
       region,
       forest_percent AS pct_designated_as_forest
FROM   forestation
WHERE  forest_percent > 75
       AND forest_percent <= 100
       AND year = 2016;
```