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 __ ***1,279,999.98***_ ***km2***_).

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***
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***_____. 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 km2***__, much lower than the figure for ___ ***China.***__ _.

__ ***China and the 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***	***282193.98***
Myanmar	***East Asia & Pacific***	***107234.0***
Nigeria	***Sub-Saharan Africa***	***106506.00***
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***	***-75.45***
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

Table 3.3: Count of Countries Grouped by Forestation Percent Quartiles, 2016:

Quartile	Number of Countries
75%-100%	*9*
50%-75%	*38*
25%-50%	*72*
0-25%	*85*

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
Suriname	*Latin America & Caribbean*	*98.2576939676578*
Micronesia, Fed. Sts.	*East Asia & Pacific*	*91.8572390715248*
Gabon	*Sub-Saharan Africa*	*90.0376418700565*
Seychelles	*Sub-Saharan Africa*	*88.4111367385789*
Palau	*East Asia & Pacific*	*87.6068085491203*

American Samoa	*East Asia & Pacific*	*87.5000875000875*
Guyana	*Latin America & Caribbean*	*83.9014489110682*
Lao PDR	*East Asia & Pacific*	*82.1082317640861*
Solomon	*Islands East Asia & Pacific*	*77.8635177945066*

94 countries had a percent forestation higher than the United States in 2016

5. RECOMMENDATIONS

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

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

  Deforestation is a great problem from 1990 to 2016 that has to be considered especially in some countries we could see a high decrease which is very important. The data has indicated that 72 countries belong to the second quartile with forestation at a level between 25 and 50%.
- *Which countries should we focus on over others?*

We could see that 4 out of 5 countries with a top percent decrease are in Sub-Saharan Africa. Togo, lost in the analysed period (1990 -2016) over 75% of the forest. Other countries we should focus on are Nigeria (61.80%), Uganda (59.13%), and Mauritania (46.75%).
We must increase the sustainable activities in these countries.

APPENDIX: SQL queries used

1. GLOBAL SITUATION

```
DROP VIEW IF EXISTS forestation;

CREATE VIEW forestation
AS
  (SELECT f.year,
          r.region,
          r.country_name,
          r.country_code,
          r.income_group,
          f.forest_area_sqkm,
          l.total_area_sq_mi,
          Round(( ( Sum(forest_area_sqkm) / Sum(total_area_sq_mi * 2.5
9) ) * 100
                )
```

```
                ::
                numeric, 2) AS percent_forest_area
FROM   land_area l
       JOIN forest_area f
         ON f.year = l.year
            AND f.country_code = l.country_code
       JOIN regions r
         ON l.country_code = r.country_code
GROUP  BY 1,
          2,
          3,
          4,
          5,
          6,
          7)
```

a. query:

```
SELECT Sum(forest_area_sqkm) AS total_world_forest_area
FROM   forestation
WHERE  year = 1990
       AND country_name = 'World'
```

b.query:

```
SELECT Sum(forest_area_sqkm) AS total_world_forest_area
FROM   forestation
WHERE  year = 2016
       AND country_name = 'World'
```

c.query:

```
SELECT (SELECT Sum(forest_area_sqkm) AS total_world_forest_area1
        FROM   forest_area
        WHERE  year = 1990
               AND country_name = 'World') - (SELECT
              Sum(forest_area_sqkm) AS total_world_forest_area2
                                               FROM   forest_area
                                               WHERE  year = 2016
                                                    AND country_name = 'Word')
       AS
       change_area
FROM   forestation
LIMIT  1;
```

d.query:

```
SELECT ( ( ( (SELECT Sum(forest_area_sqkm) AS total_world_forest_area1
              FROM   forest_area
```

```
               WHERE  year = 1990
                      AND country_name = 'World') - (SELECT
                         Sum(forest_area_sqkm) AS total_world_forest_area2
                                                  FROM   forest_area
                                                  WHERE  year = 2016
                                                         AND country_name =
                                                             'World')
                  )
                    /(SELECT Sum(forest_area_sqkm) AS total_world_forest_ara1
                      FROM   forest_area
                      WHERE  year = 1990
                             AND country_name = 'World') ) * 100 ) AS
       percentage_change_area
FROM   forestation
LIMIT  1;
```

e.query:

```
WITH tb1 AS
(
       SELECT Max(forest_area_sqkm) - Min(forest_area_sqkm) AS defores
t
       FROM   forestation), tb2 AS
(
          SELECT                        *,
                    total_area_sq_mi * 2.59 AS total_area_sq_km
          FROM      land_area
          FULL JOIN tb1
          ON        land_area.total_area_sq_mi = tb1.deforest), tb3 AS
(
       SELECT *,
              CASE
                     WHEN deforest IS NULL THEN 1324449
                     ELSE NULL
              END AS new_deforest
       FROM   tb2)
SELECT   country_name,
         total_area_sq_km
FROM     tb3
WHERE    total_area_sq_km < new_deforest
AND      year = 2016
ORDER BY total_area_sq_km DESC limit 1;
```

2. REGIONAL OUTLOOK

a.query:

```
SELECT region            AS region,
       Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sq_mi * 2.59)
) * 100 )::NUMERIC, 2) AS percentage_forest
FROM   forestation
WHERE  year = 2016
GROUP  BY region
ORDER  BY percentage_forest DESC;
```

b.query:

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

c.query:

```
WITH tb1
     AS (SELECT region,
                Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sq_mi
 * 2.59) )
                        *
                        100 )
                       ::
                       NUMERIC, 2) AS forest_area_1990
         FROM   forestation
         WHERE  year = 1990
                AND region NOT LIKE 'World'
         GROUP  BY 1),
     tb2
     AS (SELECT region,
                Round(( ( SUM(forest_area_sqkm) / SUM(total_area_sq_mi
 * 2.59) )
                        *
                        100 )
                       ::
                       NUMERIC, 2) AS forest_area_2016
         FROM   forestation
         WHERE  year = 2016
                AND region NOT LIKE 'World'
         GROUP  BY 1)
SELECT tb1.region,
```

```
       tb1.forest_area_1990,
       tb2.forest_area_2016
FROM   tb1
       join tb2
         ON tb1.region = tb2.region
ORDER  BY 2,
          3;
```

3. COUNTRY-LEVEL DETAIL

a.query:

```
WITH tb1 AS
(
       SELECT region,
              country_name,
              forest_area_sqkm
       FROM   forestation
       WHERE  year = 1990), tb2 AS
(
       SELECT region,
              country_name,
              forest_area_sqkm
       FROM   forestation
       WHERE  year = 2016)
SELECT   tb1.region,
         tb1.country_name,
         tb1.forest_area_sqkm
            AS forest_1990,
         tb2.forest_area_sqkm
            AS forest_2016,
         Round(Cast((tb1.forest_area_sqkm - tb2.forest_area_sqkm) AS
NUMERIC), 2) AS difference
FROM     tb1
JOIN     tb2
```

```
ON       tb1.country_name = tb2.country_name
WHERE    tb2.forest_area_sqkm < tb1.forest_area_sqkm
AND      tb1.region NOT LIKE 'World'
ORDER BY difference DESC limit 5;
```

b.query:

```
WITH tb1 AS
(
       SELECT region,
              country_name,
              forest_area_sqkm
       FROM   forestation
       WHERE  year = 1990), tb2 AS
(
       SELECT region,
              country_name,
              forest_area_sqkm
       FROM   forestation
       WHERE  year = 2016)
SELECT   tb1.region,
         tb1.country_name,
         tb1.forest_area_sqkm
            AS forest_1990,
         tb2.forest_area_sqkm
            AS forest_2016,
         Round(Cast((tb1.forest_area_sqkm - tb2.forest_area_sqkm) AS
                           NUMERIC), 2) AS difference,
         Round(Cast(((tb1.forest_area_sqkm - tb2.forest_area_sqkm)*100
/tb1.forest_area_sqkm) AS NUMERIC), 2) AS decrease_percent
FROM     tb1
JOIN     tb2
ON       tb1.country_name = tb2.country_name
WHERE    tb2.forest_area_sqkm < tb1.forest_area_sqkm
ORDER BY decrease_percent DESC limit 5;
```

c.query:

```
WITH tb1
     AS (SELECT *
         FROM   forestation
         WHERE  year = 2016
                AND region NOT LIKE 'World'
                AND percent_forest_area IS NOT NULL),
     tb2
```

```
     AS (SELECT *,
                CASE
                  WHEN percent_forest_area > 75 THEN 'Fourth'
                  WHEN percent_forest_area <= 75
                       AND percent_forest_area > 50 THEN 'Third'
                  WHEN percent_forest_area <= 50
                       AND percent_forest_area > 25 THEN 'Second'
                  ELSE 'First'
                END AS quartiles
         FROM   tb1)
SELECT quartiles,
       Count(*) AS quartiles_groups
FROM   tb2
GROUP  BY 1;
```

d.query:

```
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 <= 50
                      AND percent_forestation > 25 THEN '25%-50%'
                 WHEN percent_forestation <= 75
                      AND percent_forestation > 50 THEN '50%-75%'
                 ELSE '75%-100%'
               END AS quartiles
        FROM   forestation
        WHERE  percent_forestation IS NOT NULL
               AND year = 2016) sub;
SELECT country_name,
       region,
       percent_forestation
FROM   forestation
WHERE  percent_forestation > 75
       AND percent_forestation IS NOT NULL
       AND year = 2016
ORDER  BY 3 DESC;
```

e.query:

```
SELECT Count(country_name)
FROM   forestation
WHERE  year = 2016
       AND percent_forest_area > (SELECT percent_forest_area
                                  FROM   forestation
                                  WHERE  country_name = 'United State'
                                         AND year = 2016);
```