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 in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39958245.9, a loss of 1324449, 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 1279999.9891).

2. **REGIONAL OUTLOOK**

In 2016, the percent of the total land area of the world designated as forest was 31.3766530484109%. The region with the highest relative forestation was Latin America & Caribbean, with 46.14%, 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 51.08%, 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	51.08	46.14
Middle East & North Africa	1.78	2.07
World	32.41	31.37

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Latin America & Caribbean (dropped from 51.08% to 46.14%) 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. 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 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 2.14 % 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	75.44
Nigeria	Sub-Saharan Africa	62.80
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
1	85
2	72
3	38
4	9

The largest number of countries in 2016 were found in the 1 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:

American Samoa	East Asia & Pacific	0.875000875000875
Micronesia, Fed. Sts.	East Asia & Pacific	0.918572390715248
Gabon	Sub-Saharan Africa	0.900376418700565
Guyana	Latin America & Caribbean	0.839014489110682

5. 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?*

(1) There has been an increase in deforestation of the World by 1324449 between 1996 and 2016.
(2) Sub –Saharan Africa should be focused on because they are losing more forest areas rapidly.

Laws should be put in place to save the deforestation going on in the Sub Saharan Regions, also sensitization should be made to the people of this region on the harms of deforestation to the country and the World at large.

APPENDIX 5

SQL QUERIES USED FOR FORESTATION PROJECT

GLOBAL SITUATION

```
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 * 2.59                                    AS
          l_total_sqkm
             ,
          r.region,
          r.income_group,
          f.forest_area_sqkm / ( l.total_area_sq_mi * 2.59 ) * 100 AS
          percent_land
   FROM   forest_area f
          JOIN land_area AS l
            ON f.country_code = l.country_code
               AND f.year = l.year
          JOIN regions AS r
            ON l.country_code = r.country_code);
```

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

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

```
SELECT DISTINCT country_name,
                l_total_sqkm
FROM   forestation
WHERE  l_total_sqkm BETWEEN 1270000 AND 1350000;
```

```
WITH f_1990
     AS (SELECT forest_area_sqkm,
                country_name
         FROM   forestation
```

```
          WHERE  region = 'World'
                 AND year = 1990),
     f_2016
     AS (SELECT forest_area_sqkm,
                country_name
         FROM   forestation
         WHERE  region = 'World'
                AND year = 2016),
     f_9016
     AS (SELECT f_1990.forest_area_sqkm                                AS
frst_1990,
                f_2016.forest_area_sqkm                                AS
frst_2016,
                f_1990.country_name,
                f_1990.forest_area_sqkm - f_2016.forest_area_sqkm AS
CHANGE,
                ( f_2016.forest_area_sqkm - f_1990.forest_area_sqkm )
 * 100 /
                f_1990.forest_area_sqkm                                AS
                percent_change
         FROM   f_1990
                join f_2016
                  ON f_1990.country_name = f_2016.country_name)
SELECT frst_1990,
       frst_2016,
       country_name,
       CHANGE,
       Round(percent_change :: NUMERIC, 2) AS percent_change
FROM   f_9016;
```

REGIONAL OUTLOOK

```
SELECT region,
       Sum(forest_area_sqkm) / Sum(l_total_sqkm) * 100 AS percent_for
est_area
FROM   forestation
GROUP  BY 1;
```

```
SELECT region,
       Sum(forest_area_sqkm) / Sum(l_total_sqkm) * 100 AS percent_for
est_area
FROM   forestation
WHERE  country_name = 'World'
       AND year = 2016
GROUP  BY 1;
```

```
SELECT region,
       Round(Cast(Sum(forest_area_sqkm) / Sum(l_total_sqkm) * 100 AS
NUMERIC), 2
       ) AS
       percent_forest_area
```

```
FROM   forestation
WHERE  year = '2016'
GROUP  BY 1
ORDER  BY 2 DESC;
```

```
SELECT region,
       Sum(forest_area_sqkm) / Sum(l_total_sqkm) * 100 AS percent_for
est_area
FROM   forestation
WHERE  country_name = 'World'
       AND year = 1990
GROUP  BY 1;
```

```
SELECT region,
       Round(Cast(Sum(forest_area_sqkm) / Sum(l_total_sqkm) * 100 AS
NUMERIC), 2
       )AS
       percent_forest_area
FROM   forestation
WHERE  year = '1990'
GROUP  BY 1
ORDER  BY 2 DESC;
```

```
SELECT f_90.region,
       f_90.forest_area_decrease_9016
   AS
       forest_perc_1990,
       f_16.forest_area_decrease_9016
   AS
       forest_perc_2016,
       f_16.forest_area_decrease_9016 - f_90.forest_area_decrease_901
6 AS
       forest_perc_decrease
FROM   (SELECT region,
               Round(Cast(Sum(forest_area_sqkm) / Sum(l_total_sqkm) *
 100 AS
                                  NUMERIC),
               2)
               forest_area_decrease_9016
        FROM   forestation
        WHERE  year = 1990
        GROUP  BY 1
        ORDER  BY 2 DESC) f_90
       JOIN (SELECT region,
                    Round(Cast(Sum(forest_area_sqkm) / Sum(l_total_sq
km) * 100
                                       AS
                                       NUMERIC),
                    2)
                    forest_area_decrease_9016
             FROM   forestation
```

```
            WHERE  year = 2016
            GROUP  BY 1
            ORDER  BY 2 DESC) f_16
         ON f_90.region = f_16.region
ORDER  BY 2 DESC;
```

COUNTRY DETAIL

```
WITH largest_amount_decr_9016 AS
(
         SELECT   f_90.country_name,
                  f_90.region,
                  f_90.forest_area_sqkm                          AS f_
90_forest_area,
                  f_16.forest_area_sqkm                          AS f_
16_forest_area,
                  f_90.forest_area_sqkm - f_16.forest_area_sqkm AS fo
rest_area_change
         FROM    (
                         SELECT country_name,
                                region,
                                forest_area_sqkm
                         FROM   forestation
                         WHERE  year = 1990) f_90
         JOIN
                  (
                         SELECT country_name,
                                region,
                                forest_area_sqkm
                         FROM   forestation
                         WHERE  year = 2016) f_16
         ON       f_90.country_name = f_16.country_name
         AND      f_90.region = f_16.region
         GROUP BY 1,
                  2,
                  3,
                  4
         ORDER BY 5 DESC limit 20)
SELECT country_name,
       region,
       Round(forest_area_change :: numeric,2)
FROM   largest_amount_decr_9016
WHERE  forest_area_change IS NOT NULL;
```

```
WITH largest_perc_change_9016 AS
(
         SELECT   f_90.country_name,
                  f_90.region,
                  (f_90.forest_area_sqkm - f_16.forest_area_sqkm) / f
_90.forest_area_sqkm *100 AS forest_percent
         FROM    (
```

```
                        SELECT country_name,
                               region,
                               forest_area_sqkm
                        FROM   forestation
                        WHERE  year = 1990) f_90
         JOIN
                  (
                        SELECT country_name,
                               region,
                               forest_area_sqkm
                        FROM   forestation
                        WHERE  year = 2016) f_16
         ON       f_90.country_name = f_16.country_name
         AND      f_90.region = f_16.region
         GROUP BY 1,
                  2,
                  3
         ORDER BY 3 DESC limit 20)
SELECT *,
       Round(forest_percent::numeric,2)
FROM   largest_perc_change_9016
WHERE  forest_percent IS NOT NULL;
```

```
WITH t1
     AS (SELECT f.country_name,
                f.percent_land,
                CASE
                  WHEN f.percent_land <= 0.25 THEN '1'
                  WHEN f.percent_land <= 0.50 THEN '2'
                  WHEN f.percent_land <= 0.75 THEN '3'
                  ELSE '4'
                END AS percent_forest_quartiles
         FROM   forestation f
         WHERE  f.percent_land IS NOT NULL
                AND f.country_name != 'World'
                AND f.year = 2016)
SELECT DISTINCT( t1.percent_forest_quartiles ),
               Count(country_name)
                 OVER(
                   partition BY t1.percent_forest_quartiles) AS no_of
_countries
FROM   t1
ORDER  BY 1;
```

```
WITH high_quartiles_2016
     AS (SELECT country_name,
                region,
                percent_land,
                CASE
                  WHEN percent_land > 0.75 THEN 4
                  WHEN percent_land <= 0.75
```

```
                        AND percent_land > 0.5 THEN 3
                   WHEN percent_land <= 0.5
                        AND percent_land > 0.25 THEN 2
                   WHEN percent_land <= 0.25 THEN 1
                 END AS level
          FROM   forestation
          WHERE  year = 2016)
SELECT country_name,
       region,
       percent_land
FROM   high_quartiles_2016
WHERE  level = 4;
```