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 ***3.208%***.

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 km^2***).

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
Sub-Saharan Africa	32.19	27.56
South Asia	16.51	17.51
North America	35.65	36.04
Middle East & North Africa	1.78	2.07
Latin America & Caribbean	51.03	46.16
Europe & Central Asia	37.27	38.06
East Asia & Pacific	25.77	26.36

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 (32.19% to 27.56***%). 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 km^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 ***79200 km^2***, much lower than the figure for ***China***.

United States and China 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	282193.9844
Myanmar	East Asia & Pacific	107234.0039
Nigeria	Sub-Saharan Africa	106506.00098
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
1	85
2	72
3	38
4	9

The largest number of countries in 2016 were found in the ***First*** quartile. There were ***9*** countries in the top quartile (fourth 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	87.5
Gabon	Sub-Saharan Africa	90.04
Guyana	Latin America & Caribbean	83.9
Lao PDR	East Asia & Pacific	82.11
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Palau	East Asia & Pacific	87.61
Seychelles	Sub-Saharan Africa	88.41
Solomon Islands	East Asia & Pacific	77.86
Suriname	Latin America & Caribbean	98.26

4. RECOMMENDATIONS

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

1. The focus should be in that regions especially with the countries with the largest deforestation insq km and percentage. all countries can work on a higher forestation and take Iceland as an pioneer to increase forestation overall. From Table 3.1, we observe that region of Latin America & Caribbean is of serious concern. Primary focus should on Nigeria because it is in top 5 countries which has lost highestforest area and highest percentange of forest area.

2. The focus should on countries like Brazil, Indonesia, Myanmar, and Tanzania because they have lost highest forest area.

5. APPENDIX: SQL queries used

```
#GLOBAL SITUATION

CREATE VIEW forestation AS
SELECT la.country_code AS code,
       la.country_name AS country,
       rg.region AS region,
       rg.income_group AS income_group,
       la.year AS year,
       ROUND(fa.forest_area_sqkm) AS forest_area_sq_km,
       ROUND(la.total_area_sq_mi * 2.5899) AS total_area_sq_km,
       ((ROUND(fa.forest_area_sqkm) / ROUND(la.total_area_sq_mi * 2.5899)) * 100) AS
forest_percentage
FROM land_area la
FULL OUTER JOIN forest_area fa
ON la.country_code = fa.country_code AND la.year = fa.year
FULL OUTER JOIN regions rg
ON rg.country_code = la.country_code;

#What was the total forest area (in sq km) of the world in 1990?
#Please keep in mind that you can use the country record denoted as World in the region table

SELECT SUM(forest_area_sqkm)
FROM forest_area
WHERE country_name = 'World' AND year = '1990';

#What was the total forest area (in sq km) of the world in 2016?
#Please keep in mind that you can use the country record in the table is denoted as “World.”

SELECT SUM(forest_area_sqkm)
FROM forest_area
WHERE country_name = 'World' AND year = '2016';

#What was the change (in sq km) in the forest area of the world from 1990 to 2016?

SELECT b.forest_area_sqkm - a.forest_area_sqkm AS difference
FROM forest_area a
JOIN forest_area b
ON (a.year = '2016' AND b.year = '1990'
AND a.country_name = 'World' AND b.country_name = 'World');

#What was the percent change in forest area of the world between 1990 and 2016?

SELECT 100*(b.forest_area_sqkm - a.forest_area_sqkm)/b.forest_area_sqkm AS Percentage
FROM forest_area a
JOIN forest_area b
```

```
ON (a.year = '2016' AND b.year = '1990' AND a.country_name = 'World' AND b.country_name =
'World');

#If you compare the amount of forest area lost between 1990 and 2016, to which countrys total
area in 2016 is it closest to?

SELECT la.country_name,
la.total_area_sq_mi*2.59 AS total_area_sqkm, ABS((la.total_area_sq_mi*2.59)- (SELECT
a.forest_area_sqkm -
b.forest_area_sqkm AS diff_forest_area_sq_km
FROM (SELECT fa.country_code AS cc, fa.forest_area_sqkm FROM forest_area fa
WHERE fa.country_name = 'World' AND fa.year = 1990) AS a
JOIN (SELECT fa.country_code AS cc,fa.forest_area_sqkm FROM forest_area fa
WHERE fa.country_name = 'World' AND fa.year = 2016) AS b
ON a.cc = b.cc)) AS diff_fa_la_sqkm
FROM land_area la WHERE la.year = 2016 ORDER BY 3 LIMIT 1;


#REGIONAL OUTLOOK

#What was the percent forest of the entire world in 2016? Which region had the HIGHEST
percent forest in 2016, and which had the LOWEST, to 2 decimal places?
SELECT region,
        year,
        SUM(forest_area_sq_km) AS forest_area_sum,
        SUM(total_area_sq_km) AS land_area_sum,
        (SUM(forest_area_sq_km)/SUM(total_area_sq_km)) * 100 AS forest_percentage
  FROM forestation
  GROUP BY 1, 2;
SELECT region,
      year,
      ROUND(CAST(forest_percentage AS decimal), 2) AS forest_percentage
FROM forestation
WHERE (year = 2016 AND region = 'World');

 SELECT region,
      year,
      ROUND(CAST(forest_percentage AS decimal), 2) AS forest_percentage
FROM forestation
WHERE region != 'World'
ORDER BY 3 DESC
LIMIT 1;

SELECT region,
      year,
      ROUND(CAST(forest_percentage AS decimal), 2) AS forest_percentage
FROM forestation
WHERE region != 'World'
ORDER BY 3
LIMIT 1;
```

#What was the percent forest of the entire world in 1990? Which region had the HIGHEST percent forest in 1990, and which had the LOWEST, to 2 decimal places?

```
SELECT region,
        year,
        SUM(forest_area_sq_km) AS forest_area_sum,
        SUM(total_area_sq_km) AS land_area_sum,
        (SUM(forest_area_sq_km)/SUM(total_area_sq_km)) * 100 AS forest_percentage
  FROM forestation
  GROUP BY 1, 2;
SELECT region,
      year,
      ROUND(CAST(forest_percentage AS decimal), 2) AS forest_percentage
FROM forestation
WHERE (year = 1990 AND region = 'World');

 SELECT region,
      year,
      ROUND(CAST(forest_percentage AS decimal), 2) AS forest_percentage
FROM forestation
WHERE region != 'World'
ORDER BY 3 DESC
LIMIT 1;

SELECT region,
      year,
      ROUND(CAST(forest_percentage AS decimal), 2) AS forest_percentage
FROM forestation
WHERE region != 'World'
ORDER BY 3
LIMIT 1;
```

#Based on the table you created, which regions of the world DECREASED in forest area from 1990 to 2016?

```
CREATE TABLE regional_outlook AS(
SELECT        f.year,
              r.region,
ROUND(CAST((SUM(f.forest_area_sqkm)*100/SUM(l.total_area_sq_mi *2.59)) AS
NUMERIC),2) AS percentage
FROM Forest_area f
      JOIN land_area l
      ON f.Country_code = l.country_code AND f.year = l.year
      JOIN regions r
      ON f.country_code = r.country_code
WHERE f.year IN (1990, 2016) AND f.forest_area_sqkm IS NOT NULL AND l.total_area_sq_mi
IS NOT NULL
GROUP BY 1,2);
```

```
SELECT *
FROM regional_outlook
WHERE year = 2016 AND NOT region='World'
ORDER BY percentage DESC
LIMIT 7;

SELECT *
FROM regional_outlook
WHERE year = 1990 AND NOT region='World'
ORDER BY percentage ASC
LIMIT 7

#COUNTRY-LEVEL DETAIL

#Which 5 countries saw the largest amount decrease in forest area from 1990 to 2016? What was the difference in forest area for each?

WITH tab1 AS (SELECT la.country_code,
                     la.country_name,
                     la.year,
                     la.total_area_sq_mi * 2.56 AS total_area_sqkm,
                     fa.forest_area_sqkm forest_area_sqkm,
                     rg.region region,
                     (fa.forest_area_sqkm/(la.total_area_sq_mi * 2.56))*100 AS percent_forested,
                     forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
la.country_name ORDER BY l.year) AS forest_area_lost
              FROM land_area la
              JOIN forest_area fa
              ON la.country_code = fa.country_code AND la.year = fa.year
              JOIN regions rg
              ON la.country_code = fa.country_code
              WHERE l.year = '1990' OR l.year = '2016'
              ORDER BY 2, 3)

SELECT country_name, region, SUM(forest_area_lost)
FROM tab1
WHERE country_name != 'World'
GROUP BY 1, 2
ORDER BY 3 ASC
LIMIT 5

#Which 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 tab1 AS (SELECT la.country_code,
                     la.country_name,
```

```
            la.year,
            la.total_area_sq_mi * 2.56 AS total_area_sqkm,
            fa.forest_area_sqkm forest_area_sqkm,
            rg.region region,
            (fa.forest_area_sqkm/(la.total_area_sq_mi * 2.56))*100 AS percent_forested,
            forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
la.country_name ORDER BY l.year) AS forest_area_lost
        FROM land_area la
        JOIN forest_area fa
        ON la.country_code = fa.country_code AND la.year = fa.year
        JOIN regions rg
        ON la.country_code = fa.country_code
        WHERE l.year = '1990' OR l.year = '2016'
        ORDER BY 2, 3)

SELECT country_name, region, percent_forest_lost
FROM tab1
WHERE country_name != 'World'
ORDER BY 3
LIMIT 5

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

WITH tab1 AS (SELECT la.country_code,
            la.country_name,
            la.year,
            la.total_area_sq_mi * 2.56 AS total_area_sqkm,
            fa.forest_area_sqkm forest_area_sqkm,
            rg.region region,
            (fa.forest_area_sqkm/(la.total_area_sq_mi * 2.56))*100 AS percent_forested,
            forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
la.country_name ORDER BY l.year) AS forest_area_lost
        FROM land_area la
        JOIN forest_area fa
        ON la.country_code = fa.country_code AND la.year = fa.year
        JOIN regions rg
        ON la.country_code = fa.country_code
        WHERE l.year = '1990' OR l.year = '2016'
        ORDER BY 2, 3)

                                        SELECT COUNT(*), CASE WHEN
percent_forested >= 0 AND percent_forested <=25 THEN 1
            WHEN percent_forested > 25 AND percent_forested <=50 THEN 2
```

```
                WHEN percent_forested > 50 AND percent_forested <=75 THEN 3
                WHEN percent_forested > 75 AND percent_forested <=100 THEN 4
                ELSE NULL END AS quartile
FROM tab1
WHERE country_name != 'World' AND year = 2016
GROUP BY 2
```

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

```
 WITH tab1 AS (SELECT la.country_code,
                la.country_name,
                la.year,
                la.total_area_sq_mi * 2.56 AS total_area_sqkm,
                fa.forest_area_sqkm forest_area_sqkm,
                rg.region region,
                (fa.forest_area_sqkm/(la.total_area_sq_mi * 2.56))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
la.country_name ORDER BY l.year) AS forest_area_lost
            FROM land_area la
            JOIN forest_area fa
            ON la.country_code = fa.country_code AND la.year = fa.year
            JOIN regions rg
            ON la.country_code = fa.country_code
            WHERE l.year = '1990' OR l.year = '2016'
            ORDER BY 2, 3)

SELECT country_name, region, percent_forested, CASE WHEN percent_forested <= 25 THEN
1
                WHEN percent_forested > 25 AND percent_forested <=50 THEN 2
                WHEN percent_forested > 50 AND percent_forested <=75 THEN 3
                WHEN percent_forested > 75 AND percent_forested <=100 THEN 4
                ELSE NULL END AS quartile
FROM tab1
WHERE country_name != 'World' AND year = 2016)t1
WHERE quartile = 4
ORDER BY 3 DESC
```

#How many countries had a percent forestation higher than the United States in 2016?

```
WITH tab1 AS (SELECT la.country_code,
                la.country_name,
                la.year,
```

```
            la.total_area_sq_mi * 2.56 AS total_area_sqkm,
            fa.forest_area_sqkm forest_area_sqkm,
            rg.region region,
            (fa.forest_area_sqkm/(la.total_area_sq_mi * 2.56))*100 AS percent_forested,
            forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
la.country_name ORDER BY l.year) AS forest_area_lost
        FROM land_area la
        JOIN forest_area fa
        ON la.country_code = fa.country_code AND la.year = fa.year
        JOIN regions rg
        ON la.country_code = fa.country_code
        WHERE l.year = '1990' OR l.year = '2016'
        ORDER BY 2, 3)
SELECT COUNT(country_name)
FROM tab1
WHERE country_name != 'World' AND year = 2016 AND percent_forested > (SELECT
percent_forested
                                                    FROM tab1
                                                    WHERE country_name = 'US' AND year = 2016)
ORDER BY 1
```