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 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 1279999.99).

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 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 Unites States, but it only saw an increase of 79200, much lower than the figure for Iceland.

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	282193.9844
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	75.4452
Nigeria	Sub-Saharan Africa	61.7999
Uganda	Sub-Saharan Africa	59.1286
Mauritania	Sub-Saharan Africa	46.7498
Honduras	Latin America & Caribbean	45.0344

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, 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 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	98.26
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Gabon	Sub-Saharan Africa	90.04
Seychelles	Sub-Saharan Africa	88.41
Palau	East Asia & Pacific	87.60
American Samoa	East Asia & Pacific	87.50
Guyana	Latin America & Caribbean	83.90
Lao PDR	East Asia & Pacific	82.11
Solomon Islands	Sub-Saharan Africa	77.86

5. RECOMMENDATIONS

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

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

The total forest areas have fallen 3.02% from 1990 to 2016 worldwide. There are many factors that contributes to that downfall for example: illegal deforestation, corruption, climate change, natural resources contraband, pasturage saturation, etc.

Besides most of the regions of the world have increased their forest mass, there are 2 regions that have decreased their forests areas: Latin America & Caribbean and the Sub-Saharan Africa regions.

Many countries and governments have been working so hard to increase the mass of threes around the world since 1990. But there are many challenges ahead to maintain am optimum equilibrium in the nature.

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

According to the data, the top 5 countries that have decreased their forest areas, in descendent order, are: Togo with almost 76%, Nigeria with 62%, Uganda with 59%, Mauritania with 47%, and Honduras with 54% from 1990 to 2016.

There are also Latin American countries like Brazil that have decreased their forest areas.

We must focus on the areas that are in the developing countries because these decreased masses could be due to a vicious cycle of corruption, lack of opportunities, education and wrong environmental politics.

6. APPENDIX: SQL QUERIES

```sql
--APPENDIX : SQL queries used

/*Create View deforestation */
CREATE VIEW deforestation  AS
SELECT f.country_code, f.country_name, r.region,
    f.forest_area_sqkm,(l.total_area_sq_mi * 2.59) AS total_area_sqkm,
    (100.0* f.forest_area_sqkm /
    (l.total_area_sq_mi * 2.59)) AS land_percentage,
    r.income_group, f.year
FROM forest_area f
JOIN land_area l
    ON f.country_code = l.country_code
        AND f.year = l.year
JOIN regions r
    ON r.country_code = f.country_code;
```

```sql
--PART 1: Global Situation

--a
SELECT *
FROM forest_area
WHERE country_name = 'World'
AND (year = 1990);

--b
SELECT *
FROM forest_area
WHERE country_name = 'World'
AND (year = 2016);

--c
SELECT c.forest_area_sqkm - p.forest_area_sqkm
    AS change_area
FROM forest_area AS p
JOIN forest_area AS c
    ON (p.year = '1990' and c.year = '2016'
        AND p.country_name = 'World'
        AND c.country_name = 'World');
```

```sql
--d
SELECT 100.0*((c.forest_area_sqkm -p.forest_area_sqkm) /
       p.forest_area_sqkm) AS change_area
FROM forest_area AS p
JOIN forest_area AS c
    ON (p.year = '1990' and c.year = '2016'
       AND p.country_name = 'World'
       AND c.country_name = 'World');

--e
SELECT country_name, total_area_sqkm
FROM deforestation
WHERE year = 2016 AND total_area_sqkm < 1324449
ORDER BY total_area_sqkm DESC LIMIT 1;
```

```sql
--Part 2: Regional Outlook

--a
SELECT land_percentage
FROM deforestation
WHERE country_name = 'World'
AND year = '2016';

--b
SELECT land_percentage
FROM deforestation
WHERE country_name = 'World'
AND year = '1990';
```

```sql
--c
SELECT
    ROUND(CAST((forest_area_1990/ total_area_1990) * 100
    AS NUMERIC),2) AS forest_perc_1990,
    ROUND(CAST((forest_area_2016 / total_area_2016) * 100
    AS NUMERIC), 2) AS forest_perc_2016, region
FROM
   (SELECT SUM(x.forest_area_sqkm) forest_area_1990,
    SUM(x.total_area_sqkm) total_area_1990, x.region,
    SUM(y.forest_area_sqkm) forest_area_2016,
    SUM(y.total_area_sqkm) total_area_2016
FROM deforestation x, deforestation y
WHERE x.year = '1990'
    AND x.country_name != 'World'
    AND y.year = '2016'
    AND y.country_name!= 'World'
    AND x.region = y.region
GROUP BY x.region) world_regions
ORDER BY forest_perc_1990 DESC;
```

```sql
--Country-Level Detail

--a
SELECT new.country_name AS top_counties_with_largest_amount_decrease,
    (new.forest_area_sqkm - bef.forest_area_sqkm) AS forest_difference
FROM forest_area AS new
JOIN forest_area AS bef
    ON  (bef.year = '1990' AND new.year = '2016')
        AND new.country_name = bef.country_name
        WHERE new.forest_area_sqkm IS NOT NULL
            AND bef.forest_area_sqkm IS NOT NULL
            AND new.country_name != 'World'
            AND bef.country_name != 'World'
ORDER BY forest_difference LIMIT 5;
```

```sql
--b
SELECT new.country_name AS top_countires_with_largest_percent_decrease,
    (100*(new.forest_area_sqkm - bef.forest_area_sqkm) /
        bef.forest_area_sqkm) AS forest_difference_percentage
FROM forest_area AS now
JOIN forest_area AS bef
    ON  (bef.year = '1990' AND now.year = '2016')
        AND new.country_name = bef.country_name
        WHERE new.forest_area_sqkm IS NOT NULL
            AND bef.forest_area_sqkm IS NOT NULL
            AND new.country_name != 'World'
            AND bef.country_name != 'World'
ORDER BY forest_difference_percentage LIMIT 5;

--c
SELECT distinct(quartiles), COUNT(country_name) OVER (PARTITION BY quartiles) AS countries
    FROM (SELECT country_name,
      CASE WHEN land_percentage <= 25 THEN '0-25%'
      WHEN land_percentage <= 75 AND land_percentage > 50 THEN '50-75%'
      WHEN land_percentage <= 50 AND land_percentage > 25 THEN '25-50%'
      ELSE '75-100%'
    END AS quartiles
FROM deforestation
WHERE (land_percentage IS NOT NULL AND year = 2016) AND country_name <> 'World') quart;
```

```sql
--d
SELECT country_name, region, land_percentage
FROM deforestation
WHERE (year = 2016 AND land_percentage > 75)
ORDER BY land_percentage DESC;

--e

SELECT new.country_name,
    (new.forest_area_sqkm - bef.forest_area_sqkm) AS forest_difference
FROM forest_area AS new
JOIN forest_area AS bef
    ON  (bef.year = '1990' AND new.year = '2016')
        AND new.country_name = bef.country_name
    WHERE new.forest_area_sqkm IS NOT NULL
        AND bef.forest_area_sqkm IS NOT NULL
ORDER BY forest_difference DESC LIMIT 3;
```

```sql
SELECT new.country_name,
  (100*(new.forest_area_sqkm - bef.forest_area_sqkm) /
    bef.forest_area_sqkm) AS forest_proportion_change
FROM forest_area AS now
JOIN forest_area AS bef
    ON (bef.year = '1990' AND now.year = '2016')
        AND new.country_name = bef.country_name
        WHERE new.forest_area_sqkm IS NOT NULL
            AND bef.forest_area_sqkm IS NOT NULL
ORDER BY forest_proportion_change DESC LIMIT 3;
```