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 3.32%.

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 sq km).

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%
Sub-Saharan Africa	30.67%	28.79%

World	32.42%	31.38%
ME and North Africa	1.78%	2.07%
North America	35.65%	36.04%
East Asia and Pacific	25.78%	26.36%
Europe and Central Asia	37.28%	38.04%
South Asia	16.51%	17.51%

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 527,229.06 sq km. 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 79,200 sq km, much lower than the figure for China.

China and the US 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. Togo increased in forest area by 75.46 % 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 and Caribbean	541,510 sq km
Indonesia	East Asia & Pacific	282,193.99 sq km
Myanmar	East Asia & Pacific	107234.0039 sq km
Nigeria	Sub-Saharan Africa	106506 sq km
Tanzania	Sub-Saharan Africa	102320 sq km

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 and 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 and 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%
Micronesia, Fed. Sts.	East Asia & Pacific	92%
Gabon	Sub-Saharan Africa	90%
Seychelles	Sub-Saharan Africa	88%
Palau	East Asia & Pacific	88%
American Samoa	East Asia & Pacific	88%
Guyana	Latin America & Caribbean	84%
Lao PDR	East Asia & Pacific	82%
Solomon Islands	East Asia & Pacific	78%

5. RECOMMENDATIONS

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

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

After analyzing the World Bank data on rainforests, I learned that Latin America and the Caribbean contain almost half of the worlds total area of forests. Within this region, Brazil has lost the most total area of forest from 1990 to 2016. Indeed, the country of Brazil lost almost as much forest as the next four countries combined when looking at total forest area decrease from 1990-2016. Brazil los 541,510 sq km over this time period, which is equivalent to almost half of the total amount of forest lost in the entire world during that time which was 1324449 sq km. Along those lines, Sub-Saharan Africa has 4 of the top 5 countries when looking at forest percentage decrease with Togo losing just over 75% of its forests.

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

Obviously, Brazil should be a main focus when discussing the future of rainforests. Additionally, a further analyses should be considered on the Sub-Saharan Africa region. When we look at 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. Even though these countries arent nearly as big as Brazil in total area of land or forests, as a whole they do take up a considerable amount of land. Thus, a deeper dive into the Sub Sahara region is warranted to see if there are any changes that can be implemented so that these countries do not lose more of their forests, or if possible, reverse some of the losses from the past 25 years and actually gain forest area. Surprisingly, given all the news about pollution in this country, China was a bright spot in our dataset as the country was able to increase in forest area from 1990 to 2016 by 527,229.06 sq km. 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 79,200 sq km, much lower than the figure for China.

5. Appendix: SQL Queries Used

```
CREATE VIEW forestation AS
(SELECT
f.country_code,f.country_name,f.year,f.forest_area_sqkm,l.total_area_sq_mi,r.region,r.income_
group,
  ROUND (CAST((f.forest_area_sqkm*100)/(l.total_area_sq_mi*2.59) as NUMERIC ), 2)
forest_area_percent_in_sqkm
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);
```

1:

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 year, country_name, (total_area_sq_mi * 2.59) AS Total_area_sqkm
FROM land_area
WHERE year = 2016
AND (total_area_sq_mi * 2.59) <
(
(SELECT forest_area_sqkm
FROM forest_area
WHERE year = 1990
AND country_name = 'World') -
(SELECT forest_area_sqkm
FROM forest_area
WHERE year = 2016
AND country_name = 'World')
)
ORDER BY total_area_sq_mi DESC LIMIT 1;
```

Table 2.1

```
CREATE VIEW regional_outlook AS
(SELECT f.year, r.region, ROUND(CAST((SUM(f.forest_area_sqkm) / SUM(l.total_area_sq_mi *
2.59) * 100) AS NUMERIC), 2) PCT_forest_area
FROM forest_area f
INNER JOIN land_area l
ON f.country_code = l.country_code
AND f.year = l.year
INNER JOIN regions r
ON r.country_code = f.country_code
WHERE f.year IN (1990, 2016)
GROUP BY 1,2
ORDER BY PCT_forest_area DESC)
```

Table 3.1

```
WITH t1 AS
(SELECT country_name,forest_area_sqkm forest_1990,region
FROM forestation
WHERE YEAR = 1990
GROUP BY 1,2,3),
t2 AS
(SELECT country_name,forest_area_sqkm forest_2016
FROM forestation
WHERE YEAR = 2016
GROUP BY 1,2)
SELECT t1.country_name, (t2.forest_2016-t1.forest_1990) AS forest_decrease
FROM t1
JOIN t2
ON t1.country_name = t2.country_name
WHERE t2.forest_2016-t1.forest_1990 is NOT NULL
AND t1.country_name != 'World'
ORDER BY 2
LIMIT 5;
```

Table 3.2

```
WITH t1 AS
(SELECT year,country_name,forest_area_sqkm,
forest_area_percent_in_sqkm AS fap1990
FROM forestation
WHERE year = 1990
GROUP BY 1,2,3,4),
t2 AS (SELECT year,country_name,forest_area_sqkm,
forest_area_percent_in_sqkm AS fap2016
FROM forestation
WHERE year = 2016
GROUP BY 1,2,3,4)
SELECT t1.country_name,    r.region,
Round(Cast((t2.forest_area_sqkm-t1.forest_area_sqkm) AS NUMERIC),0) AS
fa_sqkm_difference,
(t2.forest_area_sqkm-t1.forest_area_sqkm)*100/t1.forest_area_sqkm AS fap_difference
FROM t1
JOIN t2
ON t1.country_name=t2.country_name
JOIN regions r
ON t1.country_name=r.country_name
WHERE t1.forest_area_sqkm-t2.forest_area_sqkm IS NOT NULL
```

```
AND t1.country_name<>'World'
ORDER BY 4 limit 5;
```

Table 3.3

```
WITH t1 AS
  (SELECT *
   FROM forestation
   WHERE YEAR = 2016
     AND region NOT LIKE 'World'
     AND forest_area_percent_in_sqkm IS NOT NULL),
     t2 AS
  (SELECT *,
          CASE
              WHEN forest_area_percent_in_sqkm > 75 THEN '75-100%'
              WHEN forest_area_percent_in_sqkm <= 75
                  AND forest_area_percent_in_sqkm > 50 THEN '50-75%'
              WHEN forest_area_percent_in_sqkm <= 50
                  AND forest_area_percent_in_sqkm >25 THEN '25-50%'
              ELSE '0-25%'
          END AS quartiles
   FROM t1)
SELECT quartiles,
       COUNT(*) AS quartiles_groups
FROM t2
GROUP BY quartiles
ORDER BY quartiles;
```

Table 3.4

```
Select f1.country_Name,r1.region, ((f1.forest_area_sqkm)*0.386102 /(l1.total_area_sq_mi)) as
forest_Percent
From forest_area f1
Join land_area l1
on f1.country_name = l1.country_name AND l1.year=f1.year
JOIN regions r1
ON r1.country_code=f1.country_code
where f1.year = '2016' AND ((f1.forest_area_sqkm)*0.386102 /(l1.total_area_sq_mi))>0.75
Order by forest_percent desc
```