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 sqkm** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9 sqkm**, a loss of **1324449 sqkm** , or **3.20%.**

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 sqkm**).

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	36.03
World	32.42	31.38
Sub-Saharan Africa	30.67	28.79
East Asia & Pacific	25.78	26.36
South Asia	16.51	17.50
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 **527229.062**. 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 **213.7%** 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 5 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 American and Caribbean	-541510
Indonesia	East Asia and Pacific	-282194
Myanmar	East Asia and Pacific	-107234
Nigeria	Sub-Saharan Africa	-106506
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 **Tongo, 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
0-25%	85
25-50%	73
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	87.61
American Samoa	East Asia & Pacific	87.50
Guyana	Latin America & Caribbean	83.90
Lao PDR	East Asia & Pacific	82.11
Solomon Islands	East Asia & Pacific	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 data between year 1990-2016 shows that forest is depleting in the entire world. The data shows that deforestation is majorly occurred in Sub-Saharan Africa region. But still rest of the world is not behind as 85 countries fall in 1st quartile while 73 countries has forest land in between 25-50%.

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

The top 5 countries whose forest area has decreased drastically in last 2.5 decades are Tongo, Nigeria, Uganda, Mauritania, Honduras where among these 5 countries 4 countries belongs to the Sub-Saharan Africa region which is an alarming bell for that 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. Other developed countries like China and United States should help these countries in tackling this situation by transferring latest technology to reduce the impact on environment.

Appendix: SQL queries

```
CREATE VIEW forestation
AS
SELECT fa.country_code AS country_code,
       fa.country_name AS country_name,
       fa.year AS year,
       fa.forest_area_sqkm,
       la.total_area_sq_mi,
       r.region,
       r.income_group
FROM forest_area AS fa
FULL JOIN land_area AS la
     ON fa.country_code = la.country_code
    AND fa.year = la.year
FULL JOIN regions AS r
     ON la.country_code= r.country_code
```

1. GLOBAL SITUATION

```
1.1 SELECT SUM(forest_area_sqkm)
FROM forestation
WHERE region = 'World' AND year = '1990';
1.2 SELECT SUM(forest_area_sqkm)
FROM forestation
WHERE region = 'World' AND year = '2016';
```

```
1.3 SELECT DISTINCT (SELECT SUM(f1.forest_area_sqkm)
     FROM forestation AS f1
     WHERE region = 'World' AND year = '1990') - (SELECT
     SUM(f2.forest_area_sqkm)
     FROM forestation AS f2
     WHERE region = 'World' AND year = '2016'
     )
FROM forestation;
1.4 WITH forest_area_1990
AS (
     SELECT f1.forest_area_sqkm
     FROM forestation AS f1
     WHERE region = 'World' AND year = '1990'
),
forest_area_2016
AS (
     SELECT f2.forest_area_sqkm
     FROM forestation AS f2
     WHERE region = 'World' AND year = '2016'
)

SELECT ((f_1990.forest_area_sqkm -
f_2016.forest_area_sqkm)/f_1990.forest_area_sqkm)*100
FROM forest_area_1990 AS f_1990, forest_area_2016 AS f_2016;

1.5 SELECT country_name,
     SUM(total_area_sq_mi*2.59)
FROM forestation
WHERE year = '2016'
GROUP BY 1
ORDER BY 2 DESC;
```

2. REGIONAL OUTLOOK

```
 WITH forest_area_1990
AS (
  SELECT fa_1.region, fa_1.forest_area_sqkm,
  (fa_1.total_area_sq_mi*2.59) AS total_area_sqkm_90
  FROM forestation AS fa_1
  WHERE year = '1990'
```

```
),
forest_area_2016 AS (
  SELECT fa_2.region, fa_2.forest_area_sqkm,
  (fa_2.total_area_sq_mi*2.59) AS total_area_sqkm_16
  FROM forestation AS fa_2
  WHERE year = '2016'
)

2.1 SELECT region,
     (SUM(forest_area_sqkm)/SUM(total_area_sqkm_16)*100) AS
     forest_percent_area
FROM forest_area_2016
WHERE region = ‘World’
GROUP BY 1;
2.2 SELECT region,
     (SUM(forest_area_sqkm)/SUM(total_area_sqkm_16)*100) AS
     forest_percent_area
FROM forest_area_2016
GROUP BY 1
ORDER BY 2 DESC;
2.3 SELECT region,
     (SUM(forest_area_sqkm)/SUM(total_area_sqkm_16)*100) AS
     forest_percent_area
FROM forest_area_2016
GROUP BY 1
ORDER BY 2;
2.4 SELECT region,
     (SUM(forest_area_sqkm)/SUM(total_area_sqkm_90)*100) AS
     forest_percent_area
FROM forest_area_1990
WHERE region = 'World'
GROUP BY 1;
2.5 SELECT region,
     (SUM(forest_area_sqkm)/SUM(total_area_sqkm_90)*100) AS
     forest_percent_area
FROM forest_area_1990
GROUP BY 1
ORDER BY 2 DESC;
```

```
2.6 SELECT region,
     (SUM(forest_area_sqkm)/SUM(total_area_sqkm_90)*100) AS
     forest_percent_area
FROM forest_area_1990
GROUP BY 1
ORDER BY 2;
```

3. COUNTRY-LEVEL DETAIL

A. SUCCESS STORIES

```
WITH forest_area_1990
AS (
  SELECT fa_1.country_name,
  fa_1.forest_area_sqkm,
  (round(fa_1.total_area_sq_mi*2.59)::numeric,2) AS
  total_area_sqkm_90
  FROM forestation AS fa_1
  WHERE year = '1990'
),
forest_area_2016 AS (
  SELECT fa_2.country_name,
  fa_2.forest_area_sqkm,
  (round(fa_2.total_area_sq_mi*2.59)::numeric,2) AS
  total_area_sqkm_16
  FROM forestation AS fa_2
  WHERE year = '2016'
)
3.1 SELECT fa_90.country_name,
     (round(fa_16.forest_area_sqkm) -
     (fa_90.forest_area_sqkm)::numeric,2) AS increased_forest_area
FROM forest_area_1990 AS fa_90
JOIN forest_area_2016 AS fa_16
     ON fa_90.country_name = fa_16.country_name
WHERE fa_16.forest_area_sqkm > fa_90.forest_area_sqkm
ORDER BY 2 DESC;
3.2 SELECT fa_16.country_name,
     (round((fa_16.forest_area_sqkm) -
     (fa_90.forest_area_sqkm)*100)::numeric,2) AS
     increased_forest_area
```

```
FROM forest_area_1990 AS fa_90
JOIN forest_area_2016 AS fa_16
     ON fa_90.country_name = fa_16.country_name
WHERE fa_16.forest_area_sqkm > fa_90.forest_area_sqkm
ORDER BY 2 DESC;
```

B. LARGEST CONCERNS

```
3.1 Table 1 SELECT fa_90.country_name,
     fa_90.region,
     (round(fa_16.forest_area_sqkm) -
     (fa_90.forest_area_sqkm)::numeric,2) AS absolute
FROM forest_area_1990 AS fa_90
JOIN forest_area_2016 AS fa_16
     ON fa_90.country_name = fa_16.country_name
WHERE fa_16.forest_area_sqkm < fa_90.forest_area_sqkm
     AND fa_90.region NOT LIKE 'World'
ORDER BY absolute
LIMIT 5;
3.2 Table 2 SELECT fa_90.country_name,
     fa_90.region,
     (round((fa_16.forest_area_sqkm) -
     (fa_90.forest_area_sqkm))*100/(fa_90.forest_area_sqkm)::numer
     ic,2) AS percent_change
FROM forest_area_1990 AS fa_90
JOIN forest_area_2016 AS fa_16
     ON fa_16.country_name = fa_90.country_name
     AND fa_90.region NOT LIKE 'World'
ORDER BY percent_change
LIMIT 5;
```

C. QUARTILES

```
3.1 WITH forest_area_2016
AS (
     SELECT fa_1.country_name, fa_1.year,
     (SUM(fa_1.forest_area_sqkm))*100/SUM(total_area_sq_mi*2.59)
     AS pct_forest
     FROM forestation AS fa_1
     WHERE year = '2016'
     GROUP BY 1,2
```

```
)
SELECT DISTINCT (quartiles),
     COUNT(country_name) OVER (PARTITION BY quartiles)
FROM
    (SELECT country_name,
      CASE
           WHEN pct_forest >= 0 AND pct_forest < 25 THEN '0-25%'
           WHEN pct_forest >= 25 AND pct_forest < 50 THEN '25-50%'
           WHEN pct_forest >= 50 AND pct_forest < 75 THEN '50-75%'
        WHEN pct_forest >= 75 AND pct_forest <= 100 THEN '75-100%'
           ELSE 'IN VALID'
           END AS quartiles
     FROM forest_area_2016
     WHERE pct_forest IS NOT NULL) AS quartile_data
ORDER BY 2 DESC;
3.2 SELECT fa_1.country_name,
     fa_1.region,
     (SUM(fa_1.forest_area_sqkm))*100/SUM(total_area_sq_mi*2.59)
     AS pct_forest
FROM forestation AS fa_1
WHERE year = '2016'
GROUP BY 1,2,3
HAVING (SUM(fa_1.forest_area_sqkm))*100/SUM(total_area_sq_mi*2.59)
>= 75
ORDER BY pct_forest DESC;
```