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 41,282,694.90 sq km in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39,958,245.90 sq km, a loss of 1,324,449.00 sq km, or 3.2%.

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 1,279,999.99 sq km).

2. REGIONAL OUTLOOK

In 2016, the percentage 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 percentage 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
World	32.42%	31.38%
Latin America & Caribbean	51.03%	46.16%
Sub-Saharan Africa	30.67%	28.79%

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 79,200.00 sq km, much lower than the figure for China.

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's forest area increased 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	-541,510.00 sq km
Indonesia	East Asia & Pacific	-282,193.98 sq km
Myanmar	East Asia & Pacific	-107,234.00 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%

When we consider countries that decreased in forest area percentage 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 Sub-Saharan Africa 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

First	85
Second	73
Third	38
Fourth	9

The largest number of countries in 2016 were found in the first 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%

4. RECOMMENDATIONS

Write out a set of recommendations as an analyst on the ForestQuery team.
- **What have you learned from the World Bank data?**

Analyzing the World Bank data, we have learned that the total forest area of the world has decreased from 1990 to 2016 by 1,324,449 sq. km or 3.2%, which is equivalent to slightly more than the whole land area of Peru. This loss of total forest area, globally, was driven by the only two regions in the data to have lost forest area, Latin America & Caribbean and Sub-Saharan Africa. Even with all other regions increasing forest area, these two regions decreased the global forest cover from 32.42% to 31.38%.

China was the only country to show significant improvement in overall forest area from 1990 to 2016 by 527,229.06 sq km. The next country with the largest increase in forest area was the United States with 79,200.00 sq km. As for the top percentage increase in forest area, Iceland was at the top with a 213.66% increase, although this can be explained by the fact that Iceland is a significantly smaller country compared to China and the United States.

We also learned that Sub_Saharan Africa is the only country in the data that shows in the top five when comparing total forest area lost and percentage forest area lost.

When looking at the countries in quartiles, we see that there are only nine countries in the top quartiles. This indicates that only nine countries have a very high percentage of forest area. The top three countries being Suriname in Latin America & Caribbean, Micronesia in East Asia & Pacific, and Gabon in Sub-Saharan Africa.

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

Efforts should be focused on countries in Sub-Saharan Africa as it is the only region to show losing the most forest area in terms of total forest area and total percentage of forest loss. Specifically the top five countries for percentage of lost forest area are Togo, Nigeria, Uganda, Mauritania, and Honduras in Latin America & Caribbean.

5. APPENDIX: SQL Queries Used

```
CREATE VIEW forestation as
SELECT f.country_code, f.country_name, f.year, round(f.forest_area_sqkm::numeric, 2) as
forest_area_sq_km, round(l.total_area_sq_mi::numeric, 2) * 2.59 as total_area_sq_km,
f.forest_area_sqkm/(l.total_area_sq_mi * 2.59) * 100 as forest_percentage, r.region,
r.income_group
FROM forest_area as 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;
```

1. GLOBAL SITUATION:

```
SELECT country_name, year,  forest_area_sq_km
FROM forestation
WHERE country_name = 'World' AND year = 1990;
```

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```
SELECT country_name, year,  forest_area_sq_km
FROM forestation
WHERE country_name = 'World' AND year = 2016;
```

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```
WITH year_2016 as (
        SELECT forest_area_sq_km as forest16
FROM forestation
WHERE region = 'World' and year = 2016
),
```

```
year_1990 as (
        SELECT forest_area_sq_km as forest90
FROM forestation
WHERE region = 'World' and year = 1990
)

SELECT year_2016.forest16, year_1990.forest90, (year_1990.forest90 -
year_2016.forest16) as difference
FROM year_2016, year_1990;
```

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```
WITH year_2016 as (
        SELECT forest_area_sq_km as forest16
FROM forestation
WHERE region = 'World' and year = 2016
),

year_1990 as (
        SELECT forest_area_sq_km as forest90
FROM forestation
WHERE region = 'World' and year = 1990
)

SELECT year_2016.forest16, year_1990.forest90, (year_1990.forest90 -
year_2016.forest16)/year_1990.forest90*100 as difference
FROM year_2016, year_1990;
```

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```
SELECT year, country_name, ROUND(total_area_sq_km,2)
FROM forestation
WHERE total_area_sq_km <= 1324449 AND year = 2016
ORDER BY total_area_sq_km DESC
LIMIT 1;
```

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2. REGIONAL OUTLOOK

```
CREATE VIEW region1
AS
SELECT r.region, l.year,
    SUM(f.forest_area_sqkm) total_forest_area_sq_km,
    SUM(l.total_area_sq_mi*2.59) AS total_area_sq_km,
```

```
        (SUM(f.forest_area_sqkm)/SUM(l.total_area_sq_mi*2.59))*100 AS
forest_percentage_region
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 l.country_code = r.country_code
WHERE l.year IN (1990, 2016)
GROUP BY r.region, l.year;
```

```
SELECT region, year, ROUND(forest_percentage_region::numeric, 2)
FROM region1
WHERE region = 'World' AND year = 2016;
```

```
SELECT region, year, ROUND(forest_percentage_region::numeric, 2)
FROM region1
WHERE year = 2016
ORDER BY forest_percentage_region DESC
LIMIT 1;
```

```
SELECT region, year, ROUND(forest_percentage_region::numeric, 2)
FROM region1
WHERE year = 2016
ORDER BY forest_percentage_region
LIMIT 1;
```

```
SELECT region, year, ROUND(forest_percentage_region::numeric, 2)
FROM region1
WHERE region = 'World' AND year = 1990;
```

```
SELECT region, year, ROUND(forest_percentage_region::numeric, 2)
FROM region1
WHERE year = 1990
ORDER BY forest_percentage_region DESC
LIMIT 1;
```

```
SELECT region, year, ROUND(forest_percentage_region::numeric, 2)
FROM region1
WHERE year = 1990
```

```
ORDER BY forest_percentage_region
LIMIT 1;
```

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```
WITH regions1990 as (
        SELECT *
        FROM region1
        WHERE year = 1990
),

regions2016 as (
        SELECT *
        FROM region1
        WHERE year = 2016
)

SELECT regions1990.region,
round(regions1990.forest_percentage_region::numeric,2) as
forest_percentage_1990,    round(regions2016.forest_percentage_region::numeric,2)
as      forest_percentage_2016
FROM regions1990
INNER JOIN regions2016
        ON regions1990.region = regions2016.region
WHERE regions1990.forest_percentage_region >
regions2016.forest_percentage_region;
```

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3. COUNTRY LEVEL DATA

```
WITH t1990 AS (
  SELECT country_name, forest_area_sq_km AS forest_area_1990
FROM forestation
WHERE year = 1990
),

t2016 AS (
  SELECT country_name, forest_area_sq_km AS forest_area_2016
FROM forestation
WHERE year = 2016
)

SELECT f1.country_name, f1.forest_area_1990, f2.forest_area_2016,
(f2.forest_area_2016 -
f1.forest_area_1990) AS forest_area_change
```

```
FROM f1990 AS f1
INNER JOIN f2016 AS f2 ON f1.country_name = f2.country_name
WHERE f2.forest_area_2016 - f1.forest_area_1990 IS NOT NULL
ORDER BY forest_area_change DESC
LIMIT 2;
```

```
WITH t1990 AS (
  SELECT country_name, forest_area_sq_km AS forest_area_1990
FROM forestation
WHERE year = 1990
),

t2016 AS (
  SELECT country_name, forest_area_sq_km AS forest_area_2016
FROM forestation
WHERE year = 2016
)

SELECT t1.country_name, t1.forest_area_1990, t2.forest_area_2016,
ROUND(((t2.forest_area_2016 - t1.forest_area_1990)/t1.forest_area_1990 *
100)::numeric, 2) AS percentage_forest_change
FROM t1990 AS t1
INNER JOIN t2016 AS t2 ON t1.country_name = t2.country_name
WHERE t2.forest_area_2016 - t1.forest_area_1990 IS NOT NULL
ORDER BY percentage_forest_change DESC
LIMIT 1;
```

```
WITH f1990 AS (
  SELECT country_name, forest_area_sq_km AS forest_area_1990
FROM forestation
WHERE year = 1990
),

f2016 AS (
  SELECT country_name, forest_area_sq_km AS forest_area_2016
FROM forestation
WHERE year = 2016
),

fregion as (
  SELECT region, country_name
  FROM regions
```

```
)

SELECT fregion.region, f1.country_name, f1.forest_area_1990, f2.forest_area_2016,
-(f2.forest_area_2016 -
f1.forest_area_1990) AS forest_area_change
FROM f1990 AS f1
INNER JOIN f2016 AS f2 ON f1.country_name = f2.country_name
INNER JOIN fregion ON f2.country_name = fregion.country_name
WHERE f2.forest_area_2016 - f1.forest_area_1990 IS NOT NULL AND
f1.country_name != 'World'
ORDER BY forest_area_change DESC
LIMIT 5;
```

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–Quartiles–

```
SELECT country_name, region, forest_area_sq_km, total_area_sq_km,
ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) AS
percentage_forest,
CASE
WHEN ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) <= 25
THEN 'First Quartile'
WHEN ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) > 25 AND
ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) <= 50 THEN
'Second Quartile'
WHEN ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) > 50 AND
ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) <= 75 THEN
'Third Quartile'
WHEN ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) > 75
THEN 'Fourth Quartile'
END AS Quartile
FROM forestation
WHERE year = 2016;
```

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```
SELECT country_name, region, forest_area_sq_km, total_area_sq_km,
ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) AS
percentage_forest,
CASE
WHEN ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) <= 25
THEN 'First
Quartile'
WHEN ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) > 25 AND
```

```
ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) <= 50 THEN
'Second
Quartile'
WHEN ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) > 50 AND
ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) <= 75 THEN
'Third Quartile'
WHEN ROUND((forest_area_sq_km/total_area_sq_km * 100)::NUMERIC, 2) > 75
THEN 'Fourth
Quartile'
END AS Quartile
FROM forestation
WHERE year = 2016
ORDER BY percentage_forest DESC;
```