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 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
Europe & Central Asia	37.28	38.04
North America	35.65	36.04
World	32.42	31.38
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 actually increased in forest area from 1990 to 2016 by 527229.062 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 79200 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 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 sq km
Indonesia	East Asia & Pacific	282193.98 sq km
Myanmar	East Asia & Pacific	107234.00 sq km
Nigeria	Sub-Saharan Africa	106506.00 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	75.4452559270073
Nigeria	Sub-Saharan Africa	61.7999309388418
Uganda	Sub-Saharan Africa	59.1286034729531
Mauritania	Sub-Saharan Africa	46.7469879518072
Honduras	Latin America & Caribbean	45.0344149459194

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 1 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	Sub-Saharan Africa	87.61
American Samoa	East Asia & Pacific	87.50
Guyana	Latin America & Caribbean	83.90
Lao PDR	East Asia & Pacific	82.11

5. RECOMMENDATIONS

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

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

Even though we have some bright spot countries that increases a tremendous amount of forest area, overall the deforestation problem still exists since the overall forest area lost from 1996 to 2016 is significant.

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

We should pay attention to Latin America and Caribbean area and Sub-Saharan Africa. Countries like Brazil is very concerning since it has the Amazon rainforest which plays an important role of regulating the world's oxygen and carbon cycles. Several countries in Sub-Saharan Africa, such as Nigeria, Tanzania, Togo, Uganda, Mauritania also worth the attention given their forest lost rate.

```
CREATE VIEW forestation AS
SELECT f.country_code, f.country_name, f.year, f.forest_area_sqkm,
l.total_area_sq_mi*2.59 as total_area_sqkm, r.region, r.income_group,
f.forest_area_sqkm/(l.total_area_sq_mi*2.59) as forest_percent
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;
```

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

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

```
SELECT
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```
        (SELECT forest_area_sqkm FROM forestation WHERE year = 1990 AND country_name
= 'World' ) -
   (SELECT forest_area_sqkm FROM forestation WHERE year = 2016 AND country_name =
'World' ) AS diff,
        ((SELECT forest_area_sqkm FROM forestation WHERE year = 1990 AND
country_name = 'World' ) -
   (SELECT forest_area_sqkm FROM forestation WHERE year = 2016 AND country_name =
'World' ))*100/(SELECT forest_area_sqkm FROM forestation WHERE year = 1990 AND
country_name = 'World' ) AS percent_change
FROM forestation;


SELECT * FROM
forestation
WHERE total_area_sqkm < 1324449 AND year = 2016
ORDER BY total_area_sqkm DESC;


SELECT * FROM
forestation
WHERE country_name = 'World' AND year = 2016;


SELECT ROUND(SUM(forest_area_sqkm)*100/SUM(total_area_sqkm),2) as
relative_forestation, region
FROM forestation
WHERE year = 2016
GROUP BY 2
ORDER BY relative_forestation DESC;


SELECT * FROM
forestation
WHERE country_name = 'World' AND year = 1990;

SELECT ROUND(SUM(forest_area_sqkm)*100/SUM(total_area_sqkm),2) as
relative_forestation, region
FROM forestation
WHERE year = 1990
GROUP BY 2
ORDER BY relative_forestation DESC;


/************************************/
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```
/*QUERIES FOR COUNTRY-LEVEL DETAIL */
/***********************************/

WITH t1 AS (SELECT country_name, forest_area_sqkm as forest_area_1990 FROM
forest_area WHERE year = 1990),
t2 AS (SELECT country_name, forest_area_sqkm as forest_area_2016 FROM forest_area
WHERE year = 2016)
SELECT (t2.forest_area_2016 - t1.forest_area_1990) AS forest_difference, t2.country_name
FROM t2
JOIN t1
ON  t2.country_name = t1.country_name
ORDER BY forest_difference DESC;

WITH t1 AS (SELECT country_name, forest_area_sqkm as forest_sqkm_1990 FROM
forestation WHERE year = 1990),
t2 AS (SELECT country_name, forest_area_sqkm as forest_sqkm_2016 FROM forestation
WHERE year = 2016)
SELECT (t2.forest_sqkm_2016 - t1.forest_sqkm_1990)/t1.forest_sqkm_1990 AS
forest_percent_difference, t2.country_name
FROM t2
JOIN t1
ON  t2.country_name = t1.country_name
ORDER BY forest_percent_difference DESC;


WITH t1 AS (SELECT country_name, forest_area_sqkm as forest_area_1990 FROM
forest_area WHERE year = 1990),
t2 AS (SELECT country_name, forest_area_sqkm as forest_area_2016 FROM forest_area
WHERE year = 2016)
SELECT (t2.forest_area_2016 - t1.forest_area_1990) AS forest_difference, t2.country_name,
r.region
FROM t2
JOIN t1
ON  t2.country_name = t1.country_name
JOIN regions r
ON r.country_name = t2.country_name
ORDER BY forest_difference ;


WITH t1 AS (SELECT country_name, forest_area_sqkm as forest_area_1990 FROM
forest_area WHERE year = 1990),
t2 AS (SELECT country_name, forest_area_sqkm as forest_area_2016 FROM forest_area
WHERE year = 2016)
```

```
SELECT (t2.forest_area_2016 - t1.forest_area_1990)*100/t1.forest_area_1990 AS
forest_difference_percent, t2.country_name, r.region
FROM t2
JOIN t1
ON  t2.country_name = t1.country_name
JOIN regions r
ON r.country_name = t2.country_name
ORDER BY forest_difference_percent ;



SELECT * FROM forestation;



SELECT SUM( CASE WHEN f.forest_percent <=  0.25 THEN 1 ELSE 0 END) as
quatile_1_count,
SUM( CASE WHEN f.forest_percent <=  0.5 AND f.forest_percent > 0.25  THEN 1 ELSE 0
END) as quatile_2_count,
SUM( CASE WHEN f.forest_percent <=  0.75 AND f.forest_percent > 0.5  THEN 1 ELSE 0
END) as quatile_3_count,
SUM( CASE WHEN f.forest_percent >  0.75   THEN 1 ELSE 0 END) as quatile_4_count
FROM forestation f
WHERE f.year = 2016 AND country_name != 'World';




SELECT f.country_name, ROUND(CAST(f.forest_percent*100 AS Decimal),2) as
forest_percentage, r.region,
NTILE(4) OVER (PARTITION BY year ORDER BY forest_percent DESC) AS
forest_percent_quatile
FROM forestation f
JOIN regions r
ON r.country_name = f.country_name
WHERE YEAR = 2016;


SELECT * FROM forest_area;
SELECT * FROM land_area;
```