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 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 1279999.9).

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	17.50
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 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 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% 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
World	World	1324449
Brazil	Latin America & Caribbean	541510
Indonesia	East Asia & Pacific	282194
Myanmar	East Asia & 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
Pakistan	South Asia	43.45

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 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	87.61
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

4. RECOMMENDATIONS

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

- *What have you learned from the World Bank data?*
- *Which countries should we focus on over others?*

There were 9 countries in the last quartile in 2016 with a very high percentage of their land designated as forest. Five of these 9 countries are in the region of East Asia & Pacific. The countries are Micronesia, Fed. Sts, Palau, American Samoa, Lao PDR, and Solomon islands. China increased in forest area from 1990 to 2016 by 527229 sq km and Unites states was the next largest increase in forest area by 79200 sq km which showed a great increase in their forest areas.
In contrast, there were 85 countries in the first quartile of forest area in 2016. The only regions of the world that decreased in percent forest area from 1990 to 2016 were Latin America & the Caribbean and Sub-Saharan Africa. The decline in forest area in these two regions was so large, which result in the percentage of forest area in the world decreasing over this time period from 32.42% to 31.38%. Brazil and Honduras in Latin America and the Caribbean region, and also Nigeria, Tanzania, Togo, Uganda, and Mauritania in Sub-Saharan Africa region are the top countries in these two regions with the largest degree of deforestation. As a result, the focus should be placed on these countries in these two regions.

5. APPENDIX: SQL Queries Used

```
DROP VIEW forestation;
CREATE VIEW forestation
As
(SELECT f.country_code,
f.year,
f.forest_area_sqkm,
l.country_name,
l.total_area_sq_mi,
r.region,
r.income_group,
l.total_area_sq_mi * 2.59 as total_area_sqkm,
ROUND((f.forest_area_sqkm /(l.total_area_sq_mi * 2.59)*100)::NUMERIC ,2) AS perc
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);


SELECT *
FROM forestation
where country_name = 'World' and  year = 1990;


SELECT *
FROM forestation
where country_name = 'World' and  year = 2016;

--Change from 1990 to 2016
SELECT
(SELECT forest_area_sqkm
FROM forestation
where country_name = 'World' and  year = 1990)
-
(SELECT forest_area_sqkm
FROM forestation
where country_name = 'World' and  year = 2016) as difference;
```

```
--Change in percentage
SELECT
((SELECT forest_area_sqkm
FROM forestation
where country_name = 'World' and  year = 1990)
-
(SELECT forest_area_sqkm
FROM forestation
where country_name = 'World' and  year = 2016))
/
(SELECT forest_area_sqkm
FROM forestation
where country_name = 'World' and  year = 1990) * 100 as diff_per;

 --forest area lost over this time period is slightly more than the entire land area of Peru
SELECT DISTINCT country_name, total_area_sqkm
FROM forestation
WHERE total_area_sqkm BETWEEN 1270000 AND  1300000;


 --2. REGIONAL OUTLOOK

 --2016 region forest percentage
SELECT region,
(SUM(forest_area_sqkm) * 100 / SUM(total_area_sqkm))
as percentage_forest_2016
FROM forestation
WHERE year = 2016
GROUP BY region
order by percentage_forest_2016 DESC;

--1990 region forest percentage
SELECT region,
(SUM(forest_area_sqkm) * 100 / SUM(total_area_sqkm))
as percentage_forest_1990
FROM forestation
WHERE year = 1990
GROUP BY region
order by percentage_forest_1990 DESC;
```

```
--3. COUNTRY-LEVEL DETAIL

WITH countries_2016 AS
(
  SELECT forest_area_sqkm AS c_2016, country_name, region
  FROM forestation
  WHERE year = 2016 and forest_area_sqkm IS NOT NULL),

  countries_1990 AS
 (
    SELECT forest_area_sqkm AS c_1990, country_name, region
  FROM forestation
  WHERE year = 1990 and forest_area_sqkm IS NOT NULL)

SELECT country_name, (c_2016 - c_1990) AS forest_change,
countries_1990.region
FROM countries_1990
JOIN countries_2016
using (country_name)
ORDER BY forest_change limit 6;


-- Percentage by countries
WITH countries_2016 AS
(
  SELECT forest_area_sqkm AS c_2016, country_name, region
  FROM forestation
  WHERE year = 2016 and forest_area_sqkm IS NOT NULL),

  countries_1990 AS
 (
    SELECT forest_area_sqkm AS c_1990, country_name, region
  FROM forestation
  WHERE year = 1990 and forest_area_sqkm IS NOT NULL)

SELECT country_name,
(c_2016 - c_1990)/c_1990*100 AS forest_change_percentage,
countries_1990.region,
ROUND(((c_2016 - c_1990)*100/c_1990)::NUMERIC,2)AS fc_percentage
FROM countries_1990
JOIN countries_2016
using (country_name)
ORDER BY fc_percentage limit 6;
```

```
--Quartiles
 WITH Q1
AS (SELECT f.country_name, f.perc,
CASE
WHEN f.perc >= 75 THEN '75%-100%'
WHEN f.perc >= 50 THEN '50%-75%'
WHEN f.perc >= 25 THEN '25%-50%'
ELSE '0-25%'
END AS quartiles
FROM forestation f
WHERE year = 2016 and f.perc IS NOT NULL
AND country_name != 'World')
SELECT quartiles, Count (*)
FROM Q1
GROUP BY quartiles
ORDER BY quartiles;

--All of the countries that were in the 4th quartile
 SELECT f.country_name, f.region, f.perc
 FROM forestation f
 WHERE f.perc IS NOT NULL AND year = 2016
 ORDER BY f.perc DESC
 LIMIT 9;
```