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 3.2%.

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 1,279.999.99sqkm).

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 and Caribbean, with 46.16%, and the region with the lowest relative forestation was Middle East and 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 and Caribbean, with 51.03%, and the region with the lowest relative forestation was Middle East and 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	36.65	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 527,229.062sqkm. 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 79.200sqkm, 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 213.66%% 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 and Caribbean	541510
INDONESIA	East Asia and Pacific	282193.98
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	74.45
NIGERIA	Sub-Saharan Africa	61.80
UGANDA	Sub-Saharan Africa	59.27
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 and Caribbean	98.26

Micronesia, Fed. Sts	East Asia and Pacific	91.86
Gabon	Sub-Saharan Africa	90.04
Seychelles	Sub-Saharan Africa	88.4
Pallau	East Asia and Pacific	87.61
American Samoa	East Asia and Pacific	87.50
Guyana	Latin America and Caribbean	83.90
Lao PDR	East Asia and Pacific	82.11
Solomon Isalands	East Asia and 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?*

Even though there is a general increase in forest area in some regions like Europe, North America, Central Asia, east Asia and the Pacific, South Asia and Middle East and North Africa, the world as a whole has a decreased total forest area from 1990 to 2016 from the resulting loss in forest area in the Sub-Saharan Africa and Latin America and Caribbean.

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

We should focus on countries like Brazil, Indonesia, Myanmar, Nigeria and Tanzania because they have the most in descending order of magnitude forest area change and that can be drastic in the coming years if not considered.

APPENDIX

1. CREATE VIEW Forestation AS
SELECT r.country_name,
 f.year,
 r.income_group,
 r.region,
 l.total_area_sq_mi,
 f.forest_area_sqkm,
 ((Sum(forest_area_sqkm) / Sum(total_area_sq_mi*2.59))*100) percentage_forest
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
GROUP BY 1,2,3,4,5,6

1A. SELECT SUM(forest_area_sqkm) total_forest_area
FROM forest_area
WHERE year = 1990
AND country_name = 'World'

1B. SELECT SUM(forest_area_sqkm) total_forest_area
FROM forest_area
WHERE year = 2016
AND country_name = 'World'

1C. SELECT(
(SELECT SUM(forest_area_sqkm) total_forest_area
FROM Forestation
WHERE year = 1990
AND country_name = 'World') -
(SELECT SUM(forest_area_sqkm) total_forest_area
FROM Forestation
WHERE year = 2016
AND country_name = 'World')) AS Difference
FROM Forestation
LIMIT 1

1D. SELECT(((
(SELECT SUM(forest_area_sqkm) total_forest_area
FROM Forestation
WHERE year = 1990
AND country_name = 'World') -
(SELECT SUM(forest_area_sqkm) total_forest_area
FROM Forestation
WHERE year = 2016
AND country_name = 'World'))/ (
(SELECT SUM(forest_area_sqkm) total_forest_area
FROM forestation
WHERE YEAR = 1990
AND country_name = 'World'))) *100) AS Percent_loss

FROM Forestation
LIMIT 1

1E. SELECT country_name,
	SUM(total_area_sq_mi*2.59) AS total_land_area
FROM Forestation
WHERE YEAR = 2016
	AND total_area_sq_mi IS NOT NULL
GROUP BY 1
ORDER BY 2 DESC

REGIONAL OUTLOOK

2A. SELECT country_name,
	round(((SUM(forest_area_sqkm)/SUM(total_area_sq_mi*2.59))*100)::Numeric, 2) AS forest_percentage_world
FROM Forestation
WHERE YEAR = 2016
	AND country_name = 'World'
GROUP BY 1

2A.1 SELECT region,
	round(((SUM(forest_area_sqkm)/SUM(total_area_sq_mi*2.59))*100)::Numeric, 2) AS forest_percentage_region
FROM Forestation
WHERE YEAR = 2016
GROUP BY 1
ORDER BY 2 DESC
LIMIT 1

2A.2 SELECT region,
	round(((SUM(forest_area_sqkm)/SUM(total_area_sq_mi*2.59))*100)::Numeric, 2) AS forest_percentage_region
FROM Forestation
WHERE YEAR = 2016
GROUP BY 1
ORDER BY 2
LIMIT 1

2b. SELECT country_name,
	round(((SUM(forest_area_sqkm)/SUM(total_area_sq_mi*2.59))*100)::Numeric, 2) AS forest_percentage_world
FROM Forestation
WHERE YEAR = 1990
	AND country_name = 'World'
GROUP BY 1

2B.1 SELECT region,
round(((SUM(forest_area_sqkm)/SUM(total_area_sq_mi*2.59))*100)::Numeric, 2) AS forest_percentage_region
FROM Forestation
WHERE YEAR = 1990
GROUP BY 1
ORDER BY 2 DESC
LIMIT 1

2b.2 SELECT region,
round(((SUM(forest_area_sqkm)/SUM(total_area_sq_mi*2.59))*100)::Numeric, 2) AS forest_percentage_region
FROM Forestation
WHERE YEAR = 1990
GROUP BY 1
ORDER BY 2
LIMIT 1

BASED ON TABLE 2

SELECT region,
ROUND(((SUM(forest_area_sqkm)/SUM(total_area_sq_mi*2.59))*100)::Numeric,2) AS percentage_by_country
FROM Forestation
WHERE YEAR = 1990
GROUP BY 1
ORDER BY 2 DESC

SELECT region,
ROUND(((SUM(forest_area_sqkm)/SUM(total_area_sq_mi*2.59))*100)::Numeric,2) AS percentage_by_country
FROM Forestation
WHERE YEAR = 2016
GROUP BY 1
ORDER BY 2 DESC

3A.

```
WITH T1 AS
(SELECT country_name,
        SUM(forest_area_sqkm) forest_area_1
 FROM Forestation
 WHERE YEAR = 1990
 GROUP BY 1,forest_area_sqkm),
 T2 AS
 (SELECT country_name,
        SUM(forest_area_sqkm) forest_area_2
  FROM Forestation
  WHERE YEAR = 2016
  GROUP BY 1,forest_area_sqkm)
  SELECT f.country_name,
        (f.forest_area_1 - t.forest_area_2) change_forest_area
  FROM T1 f
  JOIN T2 t
  ON f.country_name = t.country_name
  ORDER BY change_forest_area
  LIMIT 5
```

3B.

```
WITH T1 AS
 (SELECT country_name,
 (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 percent_forestation_1
 FROM forestation
 WHERE YEAR = 1990
 GROUP BY 1,
 forest_area_sqkm),
 T2 AS
 (SELECT country_name,
 (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 percent_forestation_2
 FROM forestation
 WHERE YEAR = 2016
 GROUP BY 1,
 forest_area_sqkm)
SELECT f.country_name,
 Round((((f.percent_forestation_1 -
t.percent_forestation_2)/(f.percent_forestation_1))*100)::Numeric, 2) percent_change_increase
FROM T1 f
JOIN T2 t ON f.country_name = t.country_name
ORDER BY percent_change_increase
```

```
LIMIT 5
```

TABLE 3.4

```
WITH T1 AS
(SELECT country_name,
        SUM(forest_area_sqkm) forest_area_1
 FROM Forestation
 WHERE YEAR = 1990
 GROUP BY 1, forest_area_sqkm),
 T2 AS
 (SELECT country_name,
        SUM(forest_area_sqkm) forest_area_2
  FROM Forestation
  WHERE YEAR = 2016
  GROUP BY 1,forest_area_sqkm)
  SELECT f.country_name,
        (f.forest_area_1 - t.forest_area_2) change_forest_area
  FROM T1 f
  JOIN T2 t
  ON f.country_name = t.country_name
  WHERE f.forest_area_1 IS NOT NULL
        AND t.forest_area_2 IS NOT NULL
    AND f.country_name != 'World'
  ORDER BY change_forest_area DESC
  LIMIT 5

WITH T1 AS
 (SELECT country_name,
 (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 percent_forestation_1
 FROM forestation
 WHERE YEAR = 1990
 GROUP BY 1,
 forest_area_sqkm),
 T2 AS
 (SELECT country_name,
 (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 percent_forestation_2
 FROM forestation
 WHERE YEAR = 2016
 GROUP BY 1,
 forest_area_sqkm)
SELECT f.country_name,
 Round((((f.percent_forestation_1 -
t.percent_forestation_2)/(f.percent_forestation_1))*100)::Numeric, 2) percent_change
FROM T1 f
```

```
JOIN T2 t ON f.country_name = t.country_name
  WHERE f.percent_forestation_1 IS NOT NULL
          AND t.percent_forestation_2 IS NOT NULL
  AND f.country_name != 'World'
ORDER BY percent_change DESC
LIMIT 5


WITH T1 AS
 (SELECT country_name,
 YEAR,
 (SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100 percent_forestation
 FROM forestation
 WHERE YEAR = 2016
 GROUP BY 1,
 YEAR,
 forest_area_sqkm)
SELECT Distinct(quartiles),
 count(country_name)Over(PARTITION BY quartiles)
FROM
 (SELECT country_name,
 CASE
          WHEN percent_forestation<25 THEN '0-25'
          WHEN percent_forestation>=25
            AND percent_forestation<50 THEN '25-50'
          WHEN percent_forestation>=50
            AND percent_forestation<75 THEN '50-75'
          ELSE '75-100'
    END AS quartiles
 FROM T1
 WHERE percent_forestation IS NOT NULL
    AND YEAR = 2016) sub
```