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 41282694.9sqkm in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39958245.9sqkm a loss of 1324449sqkm, or 3.31%.

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 1279999.9891sqkm).

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 2.06% 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
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

China is a particularly bright spot in the data at the country level. China 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 79200sqkm, much lower than the figure for China.

China and USA 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 (sqkm)
Brazil	Latin America & Caribbean	541510.00
Indonesia	East Asia & Pacific	282193.98
Myanmar	East Asia & Pacific	107234.00
Nigeria	Sub-Saharan Africa	106506.00
Tanzania	Sub-Saharan Africa	102320.00

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	61.8
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 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
First quartile	85
Second quartile	70
Third quartile	36
Fourth quartile	9

The largest number of countries in 2016 were found in the First quartile.
There were nine 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
American Samoa	East Asia & Pacific	87.5
Gabon	Sub-Saharan Africa	90.04
Lao PDR	East Asia & Pacific	82.11
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Palau	East Asia & Pacific	87.61
Seychelles	Sub-Saharan Africa	88.41
Solomon Islands	East Asia & Pacific	77.86
Suriname	Latin America & Caribbean	98.26

4. RECOMMENDATIONS

The analysis above shows the countries and regions with the highest impact of deforestation between 1990 and 2016.
We can conclude that our focus should be on the major driver of deforestation in terms of percentage reduction in forest area and absolute forest area reduction within the period, which are found in the Sub-Saharan African, Latin America & Caribbean, and East Asia & Pacific regions.
The countries are Togo, Nigeria, Uganda, Mauritania, Tanzania, Brazil, Honduras, Myanmar, and Indonesia.

APPENDIX: SQL Queries Used

```
CREATE VIEW forestation
AS (SELECT
fa.YEAR,
fa.country_code,
fa.forest_area_sqkm,
la.country_name,
la.total_area_sq_mi,
re.region,
re.income_group,
fa.forest_area_sqkm/(la.total_area_sq_mi * 2.59)* 100 forest_percentage,
la.total_area_sq_mi * 2.59 total_area_sqkm
    FROM Forestation_Project..forest_area fa
    JOIN Forestation_Project..land_area la
    ON fa.country_code = la.country_code
    AND fa.YEAR = la.YEAR
    JOIN Forestation_Project..regions re
    ON la.country_code = re.country_code);

   SELECT *
  from forestation;



--a. What was the total forest area (in sq km) of the world in 1990?
--b. What was the total forest area (in sq km) of the world in 2016? Please keep in mind
that you can use the country record in the table is denoted as “World.”

  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;


--c. What was the change (in sq km) in the forest area of the world from 1990 to 2016?
```

```sql
 --d. What was the percent change in forest area of the world between 1990 and 2016?

 --I will create 2 temporary tables for each year to be able to perform my arithmetic and
percentage

  WITH forest_2016 AS
  (SELECT  forest_area_sqkm AS area_2016
  from forestation
  where country_name = 'World' and YEAR = 2016),

   forest_1990 AS
  (SELECT  forest_area_sqkm AS area_1990
  from forestation
  where country_name = 'World' and YEAR = 1990)

 SELECT area_1990,area_2016, area_1990 - area_2016 diff,
 ROUND(((area_1990 - area_2016)*100/area_2016),2) percentage_diff
 FROM forest_2016, forest_1990;

--e. If you compare the amount of forest area lost between 1990 and 2016, to which
country's total area in 2016 is it closest to?

 SELECT Country_name,total_area_sq_mi * 2.59 total_area_sqkm
 from forestation
 WHERE YEAR = 2016
 AND total_area_sqkm BETWEEN 1200000 AND 1350000;


   REGIONAL OUTLOOK

--a. What was the percent forest of the entire world in 2016? Which region had the
HIGHEST percent forest in 2016, and which had the LOWEST, to 2 decimal places?

 SELECT ROUND((SUM(forest_area_sqkm)*100/
 SUM( (total_area_sq_mi)* 2.59)),2) percentage_forest_area, region
 FROM forestation
 WHERE year = 2016
 GROUP BY region
 ORDER BY 1 DESC;


-- b. What was the percent forest of the entire world in 1990? Which region had the
HIGHEST percent forest in 1990, and which had the LOWEST, to 2 decimal places?

 SELECT ROUND ((SUM(forest_area_sqkm)*100/
 SUM( (total_area_sq_mi)* 2.59)),2) percentage_forest_area, region
 FROM forestation
 WHERE year = 1990
 GROUP BY region
 ORDER BY 1 DESC;


--c. Based on the table you created, which regions of the world DECREASED in forest area
from 1990 to 2016?


 --Using 2 subqueries and join clause
```

```sql
 WITH region_1990
 AS(SELECT ROUND ((SUM(forest_area_sqkm)*100/
 SUM( (total_area_sq_mi)* 2.59)),2) forest_area_1990, region
 FROM forestation
 WHERE year = 1990
 GROUP BY region),

 region_2016
AS (SELECT ROUND((SUM(forest_area_sqkm)*100/
 SUM( (total_area_sq_mi)* 2.59)),2) forest_area_2016, region
 FROM forestation
 WHERE year = 2016
 GROUP BY region)

 SELECT  region_1990.forest_area_1990,
       region_2016.forest_area_2016,
 ROUND((region_2016.forest_area_2016 - region_1990.forest_area_1990),2) forest_change,
 region_1990.region
 FROM region_1990
 JOIN region_2016
 ON region_1990.region = region_2016.region
 WHERE region_1990.region NOT LIKE 'World'
 AND region_1990.forest_area_1990 > region_2016.forest_area_2016;


        COUNTRY LEVEL DETAIL

--a. Which 5 countries saw the largest amount decrease in forest area from 1990 to 2016?
What was the difference in forest area for each?

WITH country_2016
 AS(
 SELECT forest_area_sqkm forest_2016, country_name,region
 FROM forestation
 WHERE year = 2016 AND forest_area_sqkm IS NOT NULL),


 country_1990
 AS(SELECT forest_area_sqkm forest_1990, country_name
 FROM forestation
 WHERE year = 1990 AND forest_area_sqkm IS NOT NULL)

 SELECT country_1990.forest_1990, country_2016.forest_2016,
 country_1990.forest_1990 - country_2016.forest_2016 AS difference,
country_1990.country_name,
country_2016.region
 FROM country_1990
 JOIN country_2016
ON country_1990.country_name = country_2016.country_name
WHERE country_1990.country_name NOT LIKE 'World'
 ORDER BY difference DESC;


--b. Which 5 countries saw the largest percent decrease in forest area from 1990 to 2016?
What was the percent change to 2 decimal places for each?
```

```sql
 WITH country_2016
 AS(
 SELECT forest_area_sqkm forest_16 , country_name, region
 FROM forestation
 WHERE year = 2016 AND forest_area_sqkm IS NOT NULL),

 country_1990
 AS(SELECT forest_area_sqkm forest_90, country_name
 FROM forestation
 WHERE year = 1990 AND forest_area_sqkm IS NOT NULL)


 SELECT country_1990.forest_90, country_2016.forest_16,
 ROUND(((country_1990.forest_90 - country_2016.forest_16)*100/country_1990.forest_90),2 )
AS percentage_diff, country_1990.country_name, country_2016.region
 FROM country_1990
 JOIN country_2016
 ON country_1990.country_name= country_2016.country_name
WHERE country_1990.country_name NOT LIKE 'World'
ORDER BY percentage_diff DESC;


--c. If countries were grouped by percent forestation in quartiles, which group had the
most countries in it in 2016?

WITH percent_forest
AS(SELECT ROUND (forest_area_sqkm *100/
 (total_area_sq_mi* 2.59),2) AS percentage_forest_area, country_name
 FROM forestation
 WHERE year = 2016),
country_percentile
AS
 (SELECT
 case when percentage_forest_area BETWEEN 0 AND 25 THEN '0 - 25%'
  when percentage_forest_area BETWEEN 26 AND 50 THEN '26% - 50%'
  when percentage_forest_area BETWEEN 51 AND 75 THEN '51% - 75%'
  when percentage_forest_area BETWEEN 76 AND 100 THEN '76% - 100%'
  ELSE NULL END AS percentile
  FROM percent_forest)

 SELECT percentile AS percentage_forestation, count(*) AS country_count
 from country_percentile
 GROUP BY percentile
 ORDER BY 2 DESC;



--d. List all of the countries that were in the 4th quartile (percent forest > 75%) in
2016.

WITH percent_forest
AS (SELECT ROUND (forest_area_sqkm *100/
 (total_area_sq_mi* 2.59),2) percentage_forest_area, country_name,region
 FROM forestation
 WHERE year = 2016),

 Top_quartile
 AS (SELECT country_name
```

```
FROM percent_forest
where percentage_forest_area BETWEEN 76 AND 100)

SELECT t1.country_name, f1.region,f1.percentage_forest_area
FROM percent_forest f1
JOIN Top_quartile t1
ON t1.country_name = f1.country_name;
```