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 **3.208**%.

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 sqkm**).

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	-4.87
Sub-Saharan Africa	30.67	28.79	-1.88
Europe & Central Asia	37.28	38.04	0.76
East Asia & Pacific	25.78	26.36	0.58
South Asia	16.51	17.51	1.00
Middle East & North Africa	1.78	2.07	0.29
North America	35.65	36.04	0.39

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 **527229.06 sqkm**. 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 sqkm**, much lower than the figure for **China**.

United States and **China** 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	-541510.00
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	-5168.00	-75.45
Nigeria	Sub-Saharan Africa	-106506.00	-61.80
Uganda	Sub-Saharan Africa	-28092.00	-59.13
Mauritania	Sub-Saharan Africa	-1940.00	-46.75
Honduras	Latin America & Caribbean	-36640.00	-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
Q1	85

Q2	72
Q3	38
Q4	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
American Samoa	East Asia & Pacific	87.50
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Gabon	Sub-Saharan Africa	90.04
Guyana	Latin America & Caribbean	83.90
Lao PDR	East Asia & Pacific	82.11
Palau	East Asia & Pacific	87.61
Solomon Islands	East Asia & Pacific	77.86
Suriname	Latin America & Caribbean	98.26

4. RECOMMENDATIONS

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

- *What have you learned from the World Bank data?*
  Our world is facing problems, we have lost forest area over 3.2 percent
  According to table 3.3, there area around 150 countries has less than 50 percent forest area.
- *Which countries should we focus on over others?*
  In Sub-Saharan Africa should focus on improving because they have lost many percentages of forest area
  Nigeria is one of top countries that lost highest percentage as well as area

5. APPENDIX: SQL Queries Used

```
--PART 1
CREATE OR REPLACE VIEW forestation
AS
SELECT f.country_code,
       f.country_name,
       f.year,
       f.forest_area_sqkm,
       l.total_area_sq_mi,
       r.region, r.income_group,
       (f.forest_area_sqkm / (l.total_area_sq_mi * 2.59)) * 100 AS
percent_forest_area,
       l.total_area_sq_mi * 2.59 AS total_area_sqkm
 FROM forest_area f
 JOIN land_area l
 ON f.country_code = l.country_code AND f.year = l.year
 JOIN regions r
 ON l.country_code = r.country_code
--a. What was the total forest area (in sq km) of the world in 1990? Please keep in
mind that you can use the country record denoted as “World" in the region table.
SELECT f.forest_area_sqkm
       FROM forest_area f
       WHERE f.country_name = 'World'
       AND f.year = 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.”
```

```sql
SELECT f.forest_area_sqkm
       FROM forest_area f
       WHERE f.country_name = 'World'
       AND f.year = 2016;
--c. What was the change (in sq km) in the forest area of the world FROM 1990 to 2016?
--d. What was the percent change in forest area of the world between 1990 and 2016?
SELECT
 forest2016.forest_area_sqkm - forest1990.forest_area_sqkm AS change,
 100.0*(forest2016.forest_area_sqkm - forest1990.forest_area_sqkm) /
forest1990.forest_area_sqkm AS percentage
FROM forest_area  forest2016
JOIN forest_area  forest1990
   ON forest2016.country_name = forest1990.country_name
WHERE forest2016.year = '2016' AND forest1990.year = '1990'
   AND forest2016.country_name = 'World' AND forest1990.country_name = 'World'
--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 l.country_name,
      l.total_area_sq_mi * 2.59 AS total_area_sqkm,
      ABS((l.total_area_sq_mi*2.59) -
           (SELECT query1990.forest_area_sqkm - query2016.forest_area_sqkm AS
diff_forest_area_sq_km
           FROM
               (SELECT
                   f.country_code, f.forest_area_sqkm
                   FROM forest_area f
                   WHERE f.country_name = 'World'
                   AND f.year = 1990) AS query1990
               JOIN (SELECT f.country_code,f.forest_area_sqkm
                   FROM forest_area f
                   WHERE f.country_name = 'World'
                   AND f.year = 2016) AS query2016
           ON query1990.country_code = query2016.country_code)
       ) AS diff_fa_la_sqkm
FROM land_area l
WHERE l.year = 2016
ORDER BY diff_fa_la_sqkm
LIMIT 1;
```

```sql
--PART 2
--Create a table that shows the Regions and their percent forest area (sum of forest
area divided by sum of land area) in 1990 and 2016. (Note that 1 sq mi = 2.59 sq km).
CREATE OR REPLACE VIEW region_percent_forest
AS (
WITH sqkm_1990 AS
   (
       SELECT region,
              SUM(forest_area_sqkm) AS sum_forest_area_sqkm_1990,
              SUM(total_area_sqkm) AS sum_land_area_sqkm_1990,
              ROUND((SUM(forest_area_sqkm) / SUM(total_area_sqkm))::NUMERIC * 100,2)
AS percentage_forest_area_1990
       FROM forestation
       WHERE year = 1990
       GROUP BY region
   ),
   sqkm_2016 AS
   (
       SELECT region,
              SUM(forest_area_sqkm) AS sum_forest_area_sqkm_2016,
              SUM(total_area_sqkm) AS sum_land_area_sqkm_2016,
              ROUND((SUM(forest_area_sqkm) / SUM(total_area_sqkm))::NUMERIC * 100,2)
AS percentage_forest_area_2016
       FROM forestation
       WHERE year = 2016
       GROUP BY region
   )
SELECT sqkm_1990.region,
     percentage_forest_area_1990,
     percentage_forest_area_2016,
     percentage_forest_area_2016 - percentage_forest_area_1990 AS
percentage_forest_area_change
FROM sqkm_1990
INNER JOIN sqkm_2016 ON sqkm_1990.region = sqkm_2016.region
)

--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?
```

```sql
--What was the percent forest of the entire world in 2016?
SELECT percentage_forest_area_2016 FROM region_percent_forest
WHERE region = 'World'
--Which region had the HIGHEST percent forest in 2016, and which had the LOWEST, to 2
decimal places?
SELECT * FROM region_percent_forest
WHERE region != 'World'
order by percentage_forest_area_2016 DESC
----Which region had the LOWEST percent forest in 2016, to 2 decimal places?
SELECT * FROM region_percent_forest
WHERE region != 'World'
order by percentage_forest_area_2016


--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?
--What was the percent forest of the entire world in 1990?
SELECT percentage_forest_area_1990 FROM region_percent_forest
WHERE region = 'World'
--Which region had the HIGHEST percent forest in 1990, and which had the LOWEST, to 2
decimal places?
SELECT * FROM region_percent_forest
WHERE region != 'World'
order by percentage_forest_area_1990 DESC
----Which region had the LOWEST percent forest in 1990, to 2 decimal places?
SELECT * FROM percentage_forest_area_1990
WHERE region != 'World'
order by percentage_forest_area_1990

--c. Based on the table you created, which regions of the world DECREASED in forest
area FROM 1990 to 2016?
SELECT * FROM region_percent_forest
WHERE region != 'World' and percentage_forest_area_1990 > percentage_forest_area_2016



--PART 3
--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?
```

```sql
WITH sqkm_1990 AS
   (
       SELECT country_name,region, forest_area_sqkm AS forest_area_sqkm_1990
       FROM forestation
       WHERE year = 1990 AND country_name != 'World'
   ),
   sqkm_2016 AS
   (
       SELECT country_name,region, forest_area_sqkm AS forest_area_sqkm_2016
       FROM forestation
       WHERE year = 2016 AND country_name != 'World'
   )
SELECT sqkm_1990.country_name, sqkm_1990.region,
ROUND((forest_area_sqkm_2016 - forest_area_sqkm_1990)::NUMERIC,2) AS sqkm_change
FROM sqkm_1990
JOIN sqkm_2016 ON sqkm_1990.country_name = sqkm_2016.country_name
ORDER BY sqkm_change
LIMIT 5;

-- b. Which 5 countries saw the largest percent decrease in forest area FROM 1990 to
2016?
WITH sqkm_1990 AS
   (
       SELECT country_name, region, forest_area_sqkm AS forest_area_sqkm_1990
       FROM forestation
       WHERE year = 1990 AND country_name != 'World'
   ),
   sqkm_2016 AS
   (
       SELECT country_name, region, forest_area_sqkm AS forest_area_sqkm_2016
       FROM forestation
       WHERE year = 2016 AND country_name != 'World'
   )
SELECT sqkm_1990.country_name, sqkm_1990.region,
     ROUND((forest_area_sqkm_2016 - forest_area_sqkm_1990)::NUMERIC,2) AS
sqkm_change,
     ROUND(((forest_area_sqkm_2016 -
forest_area_sqkm_1990)/(forest_area_sqkm_1990))::NUMERIC * 100,2) AS percent_change
FROM sqkm_1990
```

```
INNER JOIN sqkm_2016 ON sqkm_1990.country_name = sqkm_2016.country_name
WHERE (forest_area_sqkm_2016 - forest_area_sqkm_1990) is not null
ORDER BY percent_change
LIMIT 5;

--c. If countries were grouped by percent forestation in quartiles, which group had
the most countries in it in 2016?
WITH quartile_2016 AS
   (
       SELECT
           case
               WHEN percent_forest_area <= 25.00 THEN 'Q1'
               WHEN percent_forest_area > 25.00 AND percent_forest_area <= 50.00 THEN
'Q2'
               WHEN percent_forest_area > 50.00 AND percent_forest_area <= 75.00 THEN
'Q3'
               WHEN percent_forest_area > 75.00 THEN 'Q4'
           END AS quartile
       FROM forestation
       WHERE year = 2016 AND country_code != 'WLD' AND percent_forest_area IS NOT NULL
   )
SELECT quartile, count(*) as quartile_count
FROM quartile_2016
group by quartile
order by quartile

--d.List all of the countries that were in the 4th quartile (percent forest > 75%) in
2016.
SELECT country_name, region,ROUND(percent_forest_area::NUMERIC,2)
FROM forestation
WHERE year = 2016 AND percent_forest_area > 75.00;

--e. How many countries had a percent forestation higher than the United States in
2016?
SELECT COUNT(*)
FROM forestation a
INNER JOIN forestation b ON a.year = b.year AND a.country_code = b.country_code
WHERE a.year = 2016 AND a.percent_forest_area >
                       (
```

```
        SELECT percent_forest_area
        FROM forestation
        WHERE year = 2016 AND country_code = 'USA'
    )
```