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 km2_____ in 1990. As of 2016, the most recent year for which data was available, that number had fallen to _____39958245,9 km2_____, a loss of _____1324449___km2_____, 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 km2_____).

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
East Asia & Pacific	25.78	26.36
Europe & Central Asia	37.28	38.04
Latin America & Caribbean	51.03	26.16
Middle East & North Africa	1.78	2.07
North America	35.65	36.04
South Asia	16.51	17.51
Sub–Saharan Africa	30.67	28.79
World	32.42	31.38

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 km2_____. 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_km2_____, 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_name	region	Absolute Forest Area Change
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_name	region	Pct Forest Area Change_per_1
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
Q1	85
Q2	72
Q3	38
Q4	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_name	region	Pct Designated as Forest
American Samoa	East Asia & Pacific	87,5
Micronesia, Fed. Sts.	East Asia & Pacific	91,86
Gabon	Sub-Saharan Africa	90,04
Guyana	Latin America & Caribbean	83,9
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

Seychelles	Sub-Saharan Africa	88,41

4. RECOMMENDATIONS

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

- What have you learned from the World Bank data?

From the World Bank data, it has seen the situation of forestation all over the world between 1991 and 2016. China and the United States have improved a lot at this time. The countries and regions such as Latin America & the Caribbean and Sub-Saharan Africa should learn from China and the United States. In particular, China has increased the forest area so greatly. Besides, we can see some small country have improved their forest area (such as Iceland), which is good news. Last but not least, the entire picture is not all dark, but we should improve to increase the forest area to lead to a great future.

- Which countries should we focus on over others?

From the above analysis, we should concentrate all efforts on Nigeria, which is in the top Percent Decrease in Forest Area by Country, between 1990 & 2016. Togo, Nigeria, Uganda, Mauritania, & Honduras are in the Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016, so we should focus on these countries also. Brazil, Indonesia, Myanmar, Nigeria, & Tanzania need more attention too. Last but not least, Nigeria should be given the most special consideration because of the decrease both in percentage and amount of forest area.

5. APPENDIX: SQL Queries Used

Project Deforestation Exploration

Steps to Complete

Create a View

called “forestation” by joining all three tables - forest_area, land_area, and regions in the workspace.

```
CREATE VIEW forestation AS
SELECT f.country_code,
  f.country_name,
  f.year,
  f.forest_area_sqkm,
  r.region,
  r.income_group,
  l.total_area_sq_mi * 2.59 AS total_area_sqkm,
  (f.forest_area_sqkm/(l.total_area_sq_mi*2.59))*100 AS forest_percent
FROM forest_area AS f
JOIN land_area AS l ON f.country_code = l.country_code AND f.year = l.year
JOIN regions AS r ON f.country_code = r.country_code
ORDER BY country_code;
Select * from forestation
```

1. Part 1 - Global Situation

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

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 AS total_forest_area
FROM forestation
WHERE year = 2016 AND country_name = 'World';
```

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

```
WITH a AS(
  SELECT country_code,forest_area_sqkm AS total_forest_area_1990
  FROM forestation
  WHERE year = 1990
    AND country_name = 'World'
),
b AS(
```

```
  SELECT country_code,forest_area_sqkm AS total_forest_area_2016
  FROM forestation
  WHERE year = 2016
    AND country_name = 'World'
)
SELECT (a.total_forest_area_1990 - b.total_forest_area_2016) AS total_forest_area_change
FROM a join b on a.country_code =b.country_code ;
```

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

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

OR USING SELF JOIN:

```
SELECT ((a.forest_area_sqkm-b.forest_area_sqkm)/a.forest_area_sqkm)*100
AS percent_change
FROM forestation a
INNER JOIN forestation b
ON a.country_name=b.country_name where a.country_name = 'World'
and b.country_name = 'World'
and a.year = 1990
and b.year = 2016;
```

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?

```
WITH a AS (
```

```
  SELECT country_name,forest_area_sqkm
  FROM forestation
  WHERE year = 1990
    AND country_name = 'World'
),
b AS (
  SELECT country_name,forest_area_sqkm
  FROM forestation
  WHERE year = 2016
    AND country_name = 'World'
)
Select country_name,
       total_area_sqkm,
       ABS((total_area_sqkm)-(SELECT a.forest_area_sqkm - b.forest_area_sqkm AS diff from a,b))
as change
FROM forestation
    WHERE year = 2016
    ORDER BY 3 LIMIT 1;
```

2. Part 2 - Regional Outlook

Create table

```
Create view b as
  SELECT a.*,
  (a.total_forest_area_sqkm / a.total_total_area_sqkm) * 100 AS percent_forest
FROM(
    SELECT region,year,
      SUM(forest_area_sqkm) AS total_forest_area_sqkm,
      SUM(total_area_sqkm) AS total_total_area_sqkm
    FROM forestation
    GROUP BY region,year
    HAVING (year = 2016 or year = 1990)
  ) AS a
ORDER BY region,year;
```

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?

a1. What was the percent forest of the entire world in 2016?

```
SELECT ROUND(CAST(percent_forest AS numeric),2) AS percent_fa_region
FROM b WHERE year = 2016 AND region = 'World';
```

a2. Which region had the HIGHEST percent forest in 2016

```
SELECT region,
    ROUND(CAST(total_total_area_sqkm AS NUMERIC),2) AS total_area_sqkm,
    ROUND(CAST(percent_forest AS NUMERIC),2) AS percent_forest
    FROM b
    WHERE ROUND(CAST(percent_forest AS NUMERIC),2) = (SELECT
MAX(ROUND(CAST(percent_forest AS numeric),2)) AS max_percent
FROM b
WHERE year = 2016) AND year=2016;
```

a3. which had the LOWEST, to 2 decimal places?

```
SELECT region,
    ROUND(CAST(total_total_area_sqkm AS NUMERIC),2) AS total_area_sqkm,
    ROUND(CAST(percent_forest AS NUMERIC),2) AS percent_forest
    FROM b
    WHERE ROUND(CAST(percent_forest AS NUMERIC),2) = (SELECT
MIN(ROUND(CAST(percent_forest AS numeric),2)) AS max_percent
FROM b
WHERE year = 2016) AND year=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?

b1. What was the percent forest of the entire world in 1990?

```
SELECT ROUND(CAST(percent_forest AS numeric),2) AS percent_fa_region
FROM b WHERE year = 1990 AND region = 'World';
```

b2. Which region had the HIGHEST percent forest in 1990

```
SELECT region,
```

```
    ROUND(CAST(total_total_area_sqkm AS NUMERIC),2) AS total_area_sqkm,
    ROUND(CAST(percent_forest AS NUMERIC),2) AS percent_forest
    FROM b
    WHERE ROUND(CAST(percent_forest AS NUMERIC),2) = (SELECT
MAX(ROUND(CAST(percent_forest AS numeric),2)) AS max_percent
FROM b
WHERE year = 1990) AND year=1990;
```

b3. which had the LOWEST, to 2 decimal places?

```
SELECT region,
    ROUND(CAST(total_total_area_sqkm AS NUMERIC),2) AS total_area_sqkm,
    ROUND(CAST(percent_forest AS NUMERIC),2) AS percent_forest
    FROM b
    WHERE ROUND(CAST(percent_forest AS NUMERIC),2) = (SELECT
MIN(ROUND(CAST(percent_forest AS numeric),2)) AS max_percent
FROM b
WHERE year = 1990) AND year=1990;
```

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

```
WITH c AS (SELECT * FROM b WHERE year =1990),
            d AS (SELECT * FROM b WHERE year = 2016)
SELECT c.region,
    ROUND(CAST(c.percent_forest AS NUMERIC),2) AS percent_forest_1990,
    ROUND(CAST(d.percent_forest AS NUMERIC),2) AS percent_forest_2016
  FROM c JOIN d ON c.region = d.region
  WHERE c.percent_forest > d.percent_forest;
```

3. Part 3 - 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 y90 AS
(SELECT * FROM forest_area
  WHERE year = 1990 AND forest_area_sqkm IS NOT NULL AND country_name != 'World'
 ),
```

```
y2016 AS (SELECT * FROM forest_area f
WHERE year = 2016 AND forest_area_sqkm IS NOT NULL AND country_name != 'World'
            )
 SELECT y90.country_code,
       y90.country_name,
       r.region,
       y90.forest_area_sqkm AS sqkm1990,
       y2016.forest_area_sqkm AS sqkm2016,
       y90.forest_area_sqkm - y2016.forest_area_sqkm AS change_sqkm
     FROM y90
     JOIN y2016
     ON y90.country_code = y2016.country_code
     AND (y90.forest_area_sqkm IS NOT NULL AND y2016.forest_area_sqkm IS NOT NULL)
     JOIN regions r ON y2016.country_code = r.country_code
     ORDER BY change_sqkm DESC
     LIMIT 5;
```

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?

```
WITH y90 AS
(SELECT * FROM forest_area
   WHERE year = 1990 AND forest_area_sqkm IS NOT NULL AND country_name != 'World'
 ),

y2016 AS (SELECT * FROM forest_area f
WHERE year = 2016 AND forest_area_sqkm IS NOT NULL AND country_name != 'World'
            )
 SELECT y90.country_code,
       y90.country_name,
       r.region,
       y90.forest_area_sqkm AS sqkm1990,
       y2016.forest_area_sqkm AS sqkm2016,
       y90.forest_area_sqkm - y2016.forest_area_sqkm AS change_sqkm,
       ABS(ROUND(CAST(((y2016.forest_area_sqkm-
y90.forest_area_sqkm)/y90.forest_area_sqkm*100) AS NUMERIC),2)) AS change_per_1,
       ROUND(CAST(((y2016.forest_area_sqkm-y90.forest_area_sqkm)/y90.forest_area_sqkm*100)
AS NUMERIC),2) as change_per
     FROM y90
     JOIN y2016
```

```
    ON y90.country_code = y2016.country_code
    AND (y90.forest_area_sqkm IS NOT NULL AND y2016.forest_area_sqkm IS NOT NULL)
    JOIN regions r ON y2016.country_code = r.country_code
    ORDER BY change_per
    LIMIT 5;
```

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

```
WITH a AS (
  SELECT country_name,
    CASE WHEN forest_percent < 25 THEN 'Q1'
            WHEN forest_percent >= 25 AND forest_percent < 50 THEN 'Q2'
            WHEN forest_percent >= 50 AND forest_percent < 75 THEN 'Q3'
            ELSE 'Q4' END AS quartiles
  FROM forestation
  WHERE year = 2016 AND forest_percent IS NOT NULL
)
SELECT DISTINCT quartiles, (COUNT(country_name) OVER (PARTITION BY quartiles)) AS count
FROM a ORDER BY quartiles;
```

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

```
WITH a AS (
  SELECT country_name, region,
    CASE WHEN forest_percent < 25 THEN 'Q1'
            WHEN forest_percent >= 25 AND forest_percent < 50 THEN 'Q2'
            WHEN forest_percent >= 50 AND forest_percent < 75 THEN 'Q3'
            ELSE 'Q4' END AS quartiles
  FROM forestation
  WHERE year = 2016 AND forest_percent IS NOT NULL
)
SELECT country_name,region, quartiles
FROM a WHERE quartiles = 'Q4';
```

e. How many countries had a percent forestation higher than the United States in 2016?

```
With a as(
    SELECT DISTINCT country_name FROM forestation
```

```
   WHERE forest_percent > (SELECT forest_percent FROM forestation WHERE country_name =
'United States' AND year = 2016)
   ORDER BY country_name
 ) Select count(*) from a
```