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 __3.20824258980244_____%.

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_____).

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	46.14
Europe & Central Asia	37.20	38.07
North America	35.66	36.02
Sub Saharan Africa	30.67	28.79
East Asia & Pacific	25.78	26.36
South Asia	16.53	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 _____527229.062_____. 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_____, 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 & Caribbean	541510
Indonesia	East Asia & Pacific	282193.98
Myanmar	East Asia & Pacific	107234.00
Nigeria	Sub-Saharan Africa	106506.00
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 American Carribean	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
0-25	85
25-50	72
50-75	38
75-100	9

The largest number of countries in 2016 were found in the __24-0_____ 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
Gabon	Sub-Saharan Africa	90.04
Guyana	Latin America & Caribbean	83.90
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

5. RECOMMENDATIONS

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

- *What have you learned from the World Bank data?*
- *From what we can see from the data, the world forest area has dropped from 1990 to 2016. The percentage of the drop is* 3.20% . This is slightly greater than the entire land Peru.

- *Which countries should we focus on over others?*
  We should consider the Sub-Saharan African countries - Togo, Nigeria, Uganda. These countries have had the highest percentage of forest area loss.
  Also, we should focus on Brazil, Indonesia,Myanmar because they have the highest loss of forest area.

SQL Queries

```
CREATE VIEW forestation AS (
 SELECT fa.country_code AS forest_country_code,fa.country_name AS
forest_country_name,fa.year AS f_year,r.region AS r_region, r.income_group AS
region_income_group,fa.forest_area_sqkm AS forest_area,la.total_area_sq_mi AS
land_total_area,(fa.forest_area_sqkm/(la.total_area_sq_mi*2.59))*100 AS percent_forest_area
```

```
FROM forest_area fa
JOIN land_area la
 ON fa.country_code = la.country_code
 JOIN regions r
 ON fa.country_code = r.country_code
 )
```

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

```
SELECT t1.forest_area_sqkm-t2.forest_area_sqkm AS difference
 FROM
 (SELECT fa.forest_area_sqkm ,fa.country_code AS country_code
 FROM forest_area AS fa
 WHERE fa.country_name = 'World'
 AND fa.year =1990) AS t1

JOIN (SELECT fa.forest_area_sqkm,fa.country_code AS country_code
 FROM forest_area AS fa
 WHERE fa.country_name = 'World'
 AND fa.year =2016) AS t2
 ON t1.country_code = t2.country_code
```

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

```
SELECT ((t1.forest_area_sqkm-t2.forest_area_sqkm)/t1.forest_area_sqkm)*100 AS
percentage_difference
 FROM
 (SELECT fa.forest_area_sqkm ,fa.country_code AS country_code
 FROM forest_area AS fa
 WHERE fa.country_name = 'World'
 AND fa.year =1990) AS t1

JOIN (SELECT fa.forest_area_sqkm,fa.country_code AS country_code
 FROM forest_area AS fa
 WHERE fa.country_name = 'World'
 AND fa.year =2016) AS t2
 ON t1.country_code = t2.country_code
```

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 VIEW regional_percent AS (
  SELECT
  la.year AS year,
  r.region AS region ,
  SUM(fa.forest_area_sqkm) AS sum_forest_area,
  SUM(la.total_area_sq_mi*2.59) AS sum_land_area,
  ( SUM(fa.forest_area_sqkm)/SUM(la.total_area_sq_mi*2.59))*100 AS percentage_area
  FROM forest_area AS fa
  JOIN land_area AS la
  ON fa.country_code = la.country_code
  AND fa.year = la.year
  JOIN regions AS r
  ON la.country_code = r.country_code
  GROUP BY 1,2
  ORDER BY 1,2
  )
```

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(CAST(percentage_area AS numeric),2) AS p_area
FROM region_percent
WHERE year = 2016 AND region = 'World'
```

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?

HIGHEST -2016

```
SELECT region,
```

```
ROUND(CAST(sum_land_area AS numeric),2) AS total_area,
ROUND(CAST(percentage_area AS numeric),2) AS p_area
FROM regional_percent
WHERE ROUND(CAST(percentage_area AS numeric),2) =(SELECT
MAX(ROUND(CAST(percentage_area AS numeric),2))AS max_percent
FROM regional_percent
WHERE year = 2016)
   AND year = 2016
```

LOWEST-2016

```
SELECT region,
ROUND(CAST(sum_land_area AS numeric),2) AS total_area,
ROUND(CAST(percentage_area AS numeric),2) AS p_area
FROM regional_percent
WHERE ROUND(CAST(percentage_area AS numeric),2) =(SELECT
MIN(ROUND(CAST(percentage_area AS numeric),2))AS min_percent
FROM regional_percent
WHERE year = 2016)
   AND year = 2016
```

Highest-1990

```
SELECT region,
ROUND(CAST(sum_land_area AS numeric),2) AS total_area,
ROUND(CAST(percentage_area AS numeric),2) AS p_area
FROM regional_percent
WHERE ROUND(CAST(percentage_area AS numeric),2) =(SELECT
MAX(ROUND(CAST(percentage_area AS numeric),2))AS max_percent
FROM regional_percent
WHERE year = 1990)
   AND year = 1990
```

Lowest-1990

```
SELECT region,
ROUND(CAST(sum_land_area AS numeric),2) AS total_area,
ROUND(CAST(percentage_area AS numeric),2) AS p_area
FROM regional_percent
WHERE ROUND(CAST(percentage_area AS numeric),2) =(SELECT
MIN(ROUND(CAST(percentage_area AS numeric),2))AS min_percent
FROM regional_percent
WHERE year = 1990)
    AND year = 1990
```

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

```
WITH
t1990 AS (SELECT * FROM regional_percent WHERE year = 1990),
t2016 AS (SELECT * FROM regional_percent WHERE year = 2016)
SELECT t1990.region,
ROUND(CAST(t1990.percentage_area AS NUMERIC),2) AS area_1990,
ROUND(CAST(t2016.percentage_area AS NUMERIC),2) AS area_2016
FROM t1990
JOIN t2016
ON t2016.region = t1990.region
WHERE t1990.percentage_area > t2016.percentage_area
```

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 t1990 AS
(SELECT fa.country_code, fa.country_name, fa.year, fa.forest_area_sqkm
 FROM forest_area AS fa
 WHERE fa.year = 1990
```

```
 AND fa.forest_area_sqkm IS NOT NULL
 AND fa.country_name != 'World'),
 t2016 AS
 (SELECT fa.country_code, fa.country_name, fa.year, fa.forest_area_sqkm
 FROM forest_area AS fa
 WHERE fa.year = 2016
 AND fa.forest_area_sqkm IS NOT NULL
 AND fa.country_name != 'World')

SELECT t1990.country_code,t1990.country_name,r.region,t1990.forest_area_sqkm AS
forest_1990,t2016.forest_area_sqkm AS forest_2016, t1990.forest_area_sqkm -
t2016.forest_area_sqkm AS difference_area
FROM t1990
JOIN t2016
ON t1990.country_code = t2016.country_code
AND t1990.forest_area_sqkm IS NOT NULL
AND t2016.forest_area_sqkm IS NOT NULL
JOIN regions r
ON t2016.country_code =r.country_code
ORDER BY 6 DESC
LIMIT 5
```

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 t1990 AS
(SELECT fa.country_code, fa.country_name, fa.year, fa.forest_area_sqkm
 FROM forest_area AS fa
 WHERE fa.year = 1990
 AND fa.forest_area_sqkm IS NOT NULL
 AND fa.country_name != 'World'),
 t2016 AS
 (SELECT fa.country_code, fa.country_name, fa.year, fa.forest_area_sqkm
 FROM forest_area AS fa
 WHERE fa.year = 2016
 AND fa.forest_area_sqkm IS NOT NULL
 AND fa.country_name != 'World')
```

```
SELECT t1990.country_code,t1990.country_name,r.region,t1990.forest_area_sqkm AS
forest_1990,t2016.forest_area_sqkm AS forest_2016, t1990.forest_area_sqkm -
t2016.forest_area_sqkm AS difference_area,
ABS(ROUND(CAST(((t2016.forest_area_sqkm -
t1990.forest_area_sqkm)/t1990.forest_area_sqkm*100)AS NUMERIC),2))AS
percentage_difference
FROM t1990
JOIN t2016
ON t1990.country_code = t2016.country_code
AND t1990.forest_area_sqkm IS NOT NULL
AND t2016.forest_area_sqkm IS NOT NULL
JOIN regions r
ON t2016.country_code =r.country_code
ORDER BY ROUND(CAST(((t2016.forest_area_sqkm -
t1990.forest_area_sqkm)/t1990.forest_area_sqkm*100)AS NUMERIC),2)
LIMIT 5
```

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

```
WITH t1 AS
(SELECT fa.country_code,fa.country_name,fa.year,fa.forest_area_sqkm,
 la.total_area_sq_mi*2.59 AS
total_area_sqkm,(fa.forest_area_sqkm/(la.total_area_sq_mi*2.59))*100 AS
forest_percentage
  FROM forest_area AS fa
  JOIN land_area AS la
ON fa.country_code = la.country_code
AND (fa.country_name != 'World'
AND fa.forest_area_sqkm IS NOT NULL
AND la.total_area_sq_mi IS NOT NULL)
AND (fa.year=2016 AND la.year=2016)
ORDER BY 6 DESC),
t2 AS (SELECT t1.country_code,t1.country_name,t1.year,t1,t1.forest_percentage,
 CASE WHEN t1.forest_percentage >= 75 THEN 4
 WHEN t1.forest_percentage < 75 AND t1.forest_percentage >= 50 THEN 3
```

```
 WHEN t1.forest_percentage < 50 AND t1.forest_percentage >= 25 THEN 2
 ELSE 1 END AS percentile
 FROM t1
 ORDER BY 5 DESC
 )
SELECT t2.percentile,COUNT(t2.percentile)
FROM t2
GROUP BY 1
ORDER BY 2 DESC
```

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

```
 WITH t1 AS
(SELECT fa.country_code,fa.country_name,fa.year,fa.forest_area_sqkm,
 la.total_area_sq_mi*2.59 AS
total_area_sqkm,(fa.forest_area_sqkm/(la.total_area_sq_mi*2.59))*100 AS
forest_percentage
    FROM forest_area AS fa
    JOIN land_area AS la
ON fa.country_code = la.country_code
AND (fa.country_name != 'World'
AND fa.forest_area_sqkm IS NOT NULL
AND la.total_area_sq_mi IS NOT NULL)
AND (fa.year=2016 AND la.year=2016)
ORDER BY 6 DESC),
t2 AS (SELECT t1.country_code,t1.country_name,t1.year,t1,t1.forest_percentage,
 CASE WHEN t1.forest_percentage >= 75 THEN 4
 WHEN t1.forest_percentage < 75 AND t1.forest_percentage >= 50 THEN 3
 WHEN t1.forest_percentage < 50 AND t1.forest_percentage >= 25 THEN 2
 ELSE 1 END AS percentile
 FROM t1
 ORDER BY 5 DESC
 )
SELECT t2.country_name,r.region,ROUND(CAST(t2.forest_percentage AS
NUMERIC),2)AS percent_for,t2.percentile
    FROM T2
```

```
JOIN regions r
ON t2.country_code = r.country_code
WHERE t2.percentile = 4
ORDER BY 1
```

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

```
WITH t1 AS
(SELECT fa.country_code,fa.country_name,fa.year,fa.forest_area_sqkm,
 la.total_area_sq_mi*2.59 AS
total_area_sqkm,(fa.forest_area_sqkm/(la.total_area_sq_mi*2.59))*100 AS
forest_percentage
   FROM forest_area AS fa
  JOIN land_area AS la
ON fa.country_code = la.country_code
AND (fa.country_name != 'World'
AND fa.forest_area_sqkm IS NOT NULL
AND la.total_area_sq_mi IS NOT NULL)
AND (fa.year=2016 AND la.year=2016)
ORDER BY 6 DESC)
SELECT COUNT(t1.country_name)
FROM t1
WHERE t1.forest_percentage > (SELECT t1.forest_percentage FROM t1 WHERE
t1.country_name ='United States')
```

Which countries saw the largest amount increase in forest area from 1990 to 2016?

```
select fa.country_name, fa.forest_area_sqkm
AS Forest_area_1990, faa.forest_area_sqkm
AS Forest_area_2016, faa.forest_area_sqkm- fa.forest_area_sqkm
AS difference
from forest_area fa
INNER JOIN forest_area faa
 ON fa.country_name = faa.country_name
 where fa.year = 1990 and faa.year = 2016
 and fa.forest_area_sqkm < faa.forest_area_sqkm
```

```
 order by difference desc
limit 2;
```

Which country saw the largest percentage increase from 1990 to 2016?

```
WITH T1 AS
 (SELECT forest_country_name,
 (SUM(forest_area) / SUM(land_total_area*2.59))*100 percent_forestation_1
 FROM forestation
 WHERE f_year = 1990
 GROUP BY forest_country_name,
 forest_area),
 T2 AS
 (SELECT forest_country_name,
 (SUM(forest_area) / SUM(land_total_area*2.59))*100 percent_forestation_2
 FROM forestation
 WHERE f_year = 2016
 GROUP BY forest_country_name,
 forest_area)
SELECT f.forest_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.forest_country_name = t.forest_country_name
ORDER BY percent_change
LIMIT 1
```