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 sq km_____ in 1990. As of 2016, the most recent year for which data was available, that number had fallen to _____39958245.9 sq km_____, a loss of _____1324449___, or _____3.21_____%.

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 sq km_____).

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%	46.16%
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 sq km_____. 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 sq km_____, much lower than the figure for _____China_____.

_____China_____ and _____US_____ 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
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	-75.45%
Nigeria	Sub-Saharan Africa	-61.80%
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_____, _____Mauritania_____, and _____Honduras_____. 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
1	55
2	110
3	162
4	216

The largest number of countries in 2016 were found in the _____4_____ quartile.

There were _____216_____ 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
Venezuela, RB	Latin America & Caribbean	52.74%
Cambodia	East Asia & Pacific	52.85%

Cayman Islands	Latin America & Caribbean	52.92%

4. RECOMMENDATIONS

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

- *What have you learned from the World Bank data?*

As compared between 1990 and 2016, we noticed that the area of forest is declined by 3.21%. Although almost all regions have increased in forest percentage, these numbers are small as compared to the decrease ones. Two regions have dropped percentage dramatically in forest area and contribute to the decrease of the world forest area are _Latin America & Caribbean and Sub-Saharan Africa.

Some countries has been done well in increasing the forest area percentage , such as Iceland, French Polynesia, Bahrain, Uruguay and Dominican Republic.

On the other hand, some countries has lost there forest significantly. For instance, Togo, Nigeria, Uganda, Mauritania and Honduras.

Luckily , in 2016, there are 216 countries in 4 quartile. These are countries with a very high percentage of their land area designated as forest.

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

We should focus on 5 countries that have a huge decline in forest area percentages, which are Togo, Nigeria, Uganda, Mauritania and Honduras. Especially, we should concentrate mostly on Nigeria as it dropped both percentage and sq km in forest area the most in the world.

5. APPENDIX: SQL queries used

<u>Part 1: Global situation:</u>

- Create table forestation:

```
CREATE TABLE forestation AS
SELECT f.country_code, f.country_name,f.year, r.region, f.forest_area_sqkm, l.total_area_sq_mi, l.total_area_sq_mi * 2.59 total_area_sqkm, f.forest_area_sqkm * 100 / (l.total_area_sq_mi * 2.59) percent_of_forest, r.income_group
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
```

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 region, forest_area_sqkm

FROM forestation

WHERE region = 'World' AND 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.”

```
SELECT region, forest_area_sqkm

FROM forestation

WHERE region = 'World' AND year = 2016
```

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

```
SELECT region, forest_area_sqkm, LAG (forest_area_sqkm) OVER (ORDER BY year desc)
LAG, forest_area_sqkm - (LAG (forest_area_sqkm) OVER (ORDER BY year desc)) difference

FROM forestation

WHERE region = 'World' AND (year = 2016 OR year = 1990)
```

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

```
SELECT region, forest_area_sqkm, LAG (forest_area_sqkm) OVER (ORDER BY year desc) LAG, forest_area_sqkm - (LAG (forest_area_sqkm) OVER (ORDER BY year desc)) difference, (forest_area_sqkm - (LAG (forest_area_sqkm) OVER (ORDER BY year desc))) * 100 / forest_area_sqkm percent_diff

FROM forestation

WHERE region = 'World' AND (year = 2016 OR year = 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_sqkm

FROM forestation

WHERE year = 2016 AND total_area_sqkm < 1324449

ORDER BY total_area_sqkm desc

LIMIT 1
```

Part 2: Regional Outlook:

- Create table region_comp

```
CREATE TABLE region_comp AS

SELECT year, region, sum(forest_area_sqkm) forest_area_sqkm, sum(total_area_sqkm) total_area_sqkm, sum(forest_area_sqkm)* 100/ sum(total_area_sqkm) forest_percent

FROM forestation

WHERE year IN (1990, 2016)
```

```
GROUP BY year, region

ORDER BY 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?

```
SELECT *

FROM region_comp

WHERE year = 2016 AND region = 'World'

;

SELECT year,region, forest_percent

FROM region_comp

WHERE year = 2016

ORDER BY forest_percent desc

LIMIT 1

;

SELECT year,region, forest_percent

FROM region_comp

WHERE year = 2016

ORDER BY forest_percent
```

```
LIMIT 1
```

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 year,region, forest_percent

FROM region_comp

WHERE year = 1990 AND region = 'World'

;

SELECT year,region, forest_percent

FROM region_comp

WHERE year = 1990

ORDER BY forest_percent desc

LIMIT 1

;

SELECT year,region, forest_percent

FROM region_comp

WHERE year = 1990

ORDER BY forest_percent

LIMIT 1
```

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

```
SELECT year,region, forest_percent

FROM region_comp

order by region, year
```

Part 3: Country-level detailed:

5 Countries have the largest amount increase in forest area by sq km

```
with t1 as (SELECT country_name, region,forest_area_sqkm

FROM forestation

WHERE year = 1990),

t2 as (SELECT country_name, region,forest_area_sqkm

FROM forestation

WHERE year = 2016)

SELECT t1.country_name, t1.region,t1.forest_area_sqkm forest_area_sqkm_1990, t2.forest_area_sqkm forest_area_sqkm_2016, t2.forest_area_sqkm -t1.forest_area_sqkm forest_diff

FROM t1

JOIN t2

ON t1.country_name= t2.country_name
```

```
WHERE t1.forest_area_sqkm is NOT NULL AND t2.forest_area_sqkm is NOT NULL

ORDER BY forest_diff desc

LIMIT 5
```

5 Countries have the largest amount increase in forest area by %

```
with t1 as (SELECT country_name, region,forest_area_sqkm

FROM forestation

WHERE year = 1990),

t2 as (SELECT country_name, region,forest_area_sqkm

FROM forestation

WHERE year = 2016)

SELECT t1.country_name, t1.region,t1.forest_area_sqkm forest_area_sqkm_1990, t2.forest_area_sqkm forest_area_sqkm_2016, t2.forest_area_sqkm -t1.forest_area_sqkm forest_diff, (t2.forest_area_sqkm -t1.forest_area_sqkm)*100 / t1.forest_area_sqkm percent_diff

FROM t1

JOIN t2

ON t1.country_name= t2.country_name

WHERE t1.forest_area_sqkm is NOT NULL AND t2.forest_area_sqkm is NOT NULL

ORDER BY percent_diff desc

LIMIT 5
```

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 t1 as (SELECT country_name, forest_area_sqkm

FROM forestation

WHERE year = 1990),

t2 as (SELECT country_name, forest_area_sqkm

FROM forestation

WHERE year = 2016)

SELECT t1.country_name, t1.forest_area_sqkm forest_area_sqkm_1990, t2.forest_area_sqkm forest_area_sqkm_2016, t2.forest_area_sqkm -t1.forest_area_sqkm forest_diff

FROM t1

JOIN t2

ON t1.country_name= t2.country_name

ORDER BY forest_diff

LIMIT 6
```

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 t1 as (SELECT country_name, region,forest_area_sqkm

FROM forestation
```

```
WHERE year = 1990),

t2 as (SELECT country_name, region,forest_area_sqkm

FROM forestation

WHERE year = 2016)

SELECT t1.country_name, t1.region,t1.forest_area_sqkm forest_area_sqkm_1990, t2.forest_area_sqkm forest_area_sqkm_2016, t2.forest_area_sqkm -t1.forest_area_sqkm forest_diff, (t2.forest_area_sqkm -t1.forest_area_sqkm)*100/t1.forest_area_sqkm forest_percent_diff

FROM t1

JOIN t2

ON t1.country_name= t2.country_name

ORDER BY forest_percent_diff

LIMIT 5
```

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

```
with t1 as

(SELECT country_name, percent_of_forest, NTILE(4) OVER (ORDER BY percent_of_forest) quartiles

FROM forestation

WHERE year = 2016
```

```
ORDER BY percent_of_forest)

SELECT t1.quartiles,sum(t1.quartiles)

FROM t1

GROUP BY t1.quartiles

ORDER BY 2 desc
```

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

```
with t1 as

(SELECT country_name,region, percent_of_forest, NTILE(4) OVER (ORDER BY percent_of_forest) quartiles

FROM forestation

WHERE year = 2016

ORDER BY percent_of_forest)

SELECT t1.country_name, t1.region,t1.percent_of_forest

FROM t1

WHERE t1.quartiles = 4

ORDER BY 3
```

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

```
SELECT count(*)
FROM forestation
WHERE percent_of_forest > (SELECT percent_of_forest
FROM forestation
WHERE country_name = 'United States' AND year = 2016)
```