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 3.21%.

The forest area lost over this time period is slightly more than the entire land area of Peru listed for the year 2016 (which is1,279,999.98 km^2).

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 and the Caribbean, with 46.16%, and the region with the lowest relative forestation was Middle East and 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 51.03%, and the region with the lowest relative forestation was Middle East and 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 and Caribbean	51.03%	46.16%
Europe and Central Asia	37.28%	38.04%

North America	35.65%	36.04%
World	32.42%	31.38%
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 and 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 527,229.06 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 79,200 km2 , much lower than the figure for China. China and the U.S 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 and Caribbean	541,510 km2
Indonesia	East Asia and Pacific	282,193.98 km2
Myanmar	East Asia and Pacific	107,234 km2
Nigeria	Sub-Saharan Africa	106506 km2
Tanzania	Sub-Saharan Africa	102,320 km2

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	59.27%
Mauritania	Sub-Saharan Africa	46.75%
Honduras	Latin America and Caribbean	45.03%

When we consider countries that decreased in forest area 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 and 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 mile 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 bottom or (1st) 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
Suriname	Latin America and Caribbean	98.26
Micronesia, Fed. Sts.	East Asia and Pacific	91.86
Gabon	Sub-Saharan Africa	90.04
Seychelles	Sub-Saharan Africa	88.41
Palau	East Asia and Pacific	87.61
American Samoa	East Asia and Pacific	87.5
Guyana	Latin America and Caribbean	83.9
Lao PDR	East Asia and Pacific	82.11
Solomon Islands	East Asia and Pacific	77.86

4. RECOMMENDATIONS

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

- *What have you learned from the World Bank data?*
- *Which countries should we focus on over others?*

I discovered that forest coverage is expanding in many parts of the planet. For example, forest area and proportion are expanding across Europe and Central Asia, North America, East Asia

and the Pacific, South Asia, and the Middle East and North Africa. The fact that the world's forest acreage shrank from 1990 to 2016 highlights how much woodland Latin America and the Caribbean, as well as Sub-Saharan Africa, have lost.
I recommend concentrating on the countries with the greatest absolute forest area change. Brazil, Indonesia, Myanmar, Nigeria, and Tanzania are the top five countries in this area. While looking at nations with a high proportion of forest loss is informative, I believe that focusing on countries that are reducing forest loss is more valuable.

5. APPENDIX

```
1. Create a View called "forestation" by joining all three tables - forest_area,
land_area and regions in the workspace.

CREATE VIEW forestation AS SELECT r.country_name, fa.year, r.income_group, r.region,
l.total_area_sq_mi,l.total_area_sq_mi*2.59 AS total_sqkm_area , fa.forest_area_sqkm,
((SUM(forest_area_sqkm) / SUM(total_area_sq_mi*2.59))*100) forest_percentage
FROM forest_area fa
JOIN land_area l ON fa.country_code = l.country_code AND fa.year = l.year
JOIN regions r ON r.country_code = fa.country_code
GROUP BY r.country_name, fa.year, r.income_group, r.region, l.total_area_sq_mi,
fa.forest_area_sqkm

2. The forest_area and land_area tables join on both country_code AND year.
JOIN land_area l ON f.country_code = l.country_code AND f.year = l.year

3. The regions table joins these based on only country_code.
JOIN regions r ON r.country_code = f.country_code


4. In the 'forestation' View, include the following:
All of the columns of the origin tables
A new column that provides the percent of the land area that is designated as forest.
CREATE VIEW Forestation AS SELECT r.country_name, f.year, r.income_group, r.region,
l.total_area_sq_mi, f.forest_area_sqkm, ((SUM(forest_area_sqkm) /
SUM(total_area_sq_mi*2.59))*100) percentage_forest
```

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 SUM(f.forest_area_sqkm)

FROM forest_area f

JOIN regions r ON r.country_name = f.country_name

WHERE f.year = 1990 AND r.region = '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 SUM(f.forest_area_sqkm)

FROM forest_area f

JOIN regions r ON r.country_name = f.country_name

WHERE f.year = 2016 AND r.region = 'World'
```

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

```
SELECT forest_area_sqkm * 100/total_sqkm_area AS percent_forest

FROM forestation

 WHERE year = 2016 AND country_name='World';
```

Which region had the HIGHEST percent forest in 2016?

```
SELECT region, ROUND(CAST(forest_percentage AS numeric ), 2)
```

FROM (SELECT region, SUM(forest_area_sqkm)*100/SUM(`total_sqkm_area`) AS forest_percentage FROM forestation WHERE year = 2016 GROUP BY 1) sub

ORDER BY 2

DESC LIMIT 1;

Which region had the LOWEST percent forest in 2016?

SELECT region, ROUND(CAST(forest_percentage AS numeric), 2)

FROM (SELECT region,

SUM(forest_area_sqkm)*100/SUM(`total_sqkm_area`) AS forest_percentage

FROM forestation

WHERE year = 2016

GROUP BY 1) sub

ORDER BY 2 LIMIT 1;

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

SELECT forest_area_sqkm * 100/ `total_sqkm_area` AS forest_percentage

FROM forestation

WHERE year=1990 AND country_name = 'World'

Which region had the HIGHEST percent forest in 1990?

SELECT region, ROUND(CAST(forest_percentage AS numeric), 2)

FROM (SELECT region,

```
SUM(forest_area_sqkm)*100/SUM(total_sqkm_area) AS forest_percentage

FROM forestation

WHERE year = 1990 AND region NOT LIKE 'World'

GROUP BY region) sub

GROUP BY 1, 2

ORDER BY 2 DESC LIMIT 1;
```

Which region had the LOWEST percent forest in 1990?

```
SELECT region, ROUND(CAST(forest_percentage AS numeric ), 2)

FROM (SELECT region, SUM(forest_area_sqkm)*100/SUM(total_sqkm_area) AS
forest_percentage

FROM forestation

WHERE year = 1990 AND region NOT LIKE 'World' GROUP BY 1) sub

ORDER BY 2 ASC LIMIT 1;
```

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

```
WITH tb1 AS
( SELECT region, SUM ( forest_sqkm_area) AS total_1990
 FROM forestation
WHERE year=1990 AND region NOT LIKE 'World'
GROUP BY 1) , tb2 AS (SELECT region , SUM (forest_sqkm_area ) AS total_2016
FROM forestation
WHERE year = 2016 AND region NOT LIKE 'World' GROUP BY 1)
SELECT tb1.region, tb1.total_1990, tb2.total_2016
```

```
FROM tb1
JOIN tb2 ON tb1.region=tb2.region
WHERE tb2.total_2016<tb1.total_1990;
```

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

```
WITH tb1 AS ( SELECT *
FROM forestation
WHERE year = 2016 AND region NOT LIKE 'World' AND forest_percentage IS NOT NULL ),
tb2 AS ( SELECT *, CASE WHEN forest_percentage> 75 THEN 'Fourth' WHEN
forest_percentage <= 75 AND forest_percentage > 50 THEN 'Third' WHEN
forest_percentage <= 50 AND forest_percentage > 25 THEN 'Second' ELSE 'First' END AS
quartiles FROM tb1 )
SELECT quartiles , COUNT(*) AS quartiles_groups
FROM tb2 GROUP BY 1;
```

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

```
SELECT distinct(quartiles),
COUNT(country_name) OVER (PARTITION BY quartiles)
FROM ( SELECT country_name,
CASE WHEN forest_percentage  <= 25 THEN '0-25%' WHEN forest_percentage <= 50 AND
forest_percentage >25 THEN '25%-50%' WHEN forest_percentage <= 75 AND
forest_percentage>50 THEN '50%-75%'  ELSE '75 %-100 %' END AS quartiles
FROM forestation
WHERE forest_percentage IS NOT NULL AND year=2016) sub;
```

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

```
SELECT COUNT(country_name)
FROM forestation
```

WHERE year = 2016 AND forest_percentage > (SELECT forest_percentage FROM forestation WHERE country_name= ‘United States’ AND year=2016)