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 sq km, or 3.2%.

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 494208.49 sq mi [1279999.99 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
World	32.42	31.38

Latin America & Caribbean	51.03	46.16
Middle East & North Africa	1.78	2.07
East Asia & Pacific	25.78	26.36
Europe & Central Asia	37.28	38.04
North America	35.65	36.04
South Asia	16.51	17.51
Sub-Saharan Africa	30.67	28.79

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Sub-Saharan Africa (dropped from 30.67% to 28.79%) and Latin America & Caribbean (51.03% to 46.16%). 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. 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
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	-75.45
Nigeria	Sub-Saharan Africa	-61.80
Uganda	Sub-Saharan Africa	-59.27
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
1	85
2	72

3	38
4	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
Suriname	Latin America & Caribbean	98.26
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Gabon	Sub-Saharan Africa	90.04
Seychelles	Sub-Saharan Africa	88.41
Palau	East Asia & Pacific	87.61
American Samoa	East Asia & Pacific	87.50
Guyana	Latin America & Caribbean	83.90
Lao PDR	East Asia & Pacific	82.11
Solomon Islands	East Asia & 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?*

After reviewing the data, I recommend to take a few necessary step in attempt to stop the deforestation all around the world:

1. First of all, I think countries are too small of entities to really change the situation, and I believe it would be better to look at the wider regional picture.
2. It seems that the region with highest deforestation pace is Latin America & Caribbean, which went down from 51.03% to 46.16% in 2016. This region has the largest percentage of forest and also 37 out of 42 countries in the region have high or higher-middle income. I believe there is a correlation between the two things and the region obviously exploit its forest resource to export wood. My recommendation here would be

on one hand to increase the environmental education and awareness there in order to expose it to the deforestation danger. On the other hand, I would try to find an economic substitute to the wood-chopping industry so the region would not be affected by the change.

3. The second problematic region is Sub-Saharan Africa, which experience a decrease of 30.67% to 28.79%. In addition, 41 out of 48 countries there have low or lower-middle income. Therefore it's clear to me there is a correlation between the two things, and I would put in most of the effort there trying to help this region recover and improve economically. I believe this will decrease its economic dependency on wood chopping.

5. APPENDIX: SQL Queries Used

1./*This query creates a new table with all the relevant data from the original tables and additional columns of forest percentage per country (as 'percentage') and calculated land area per country in sq km.*/

```
CREATE VIEW forestation AS
(SELECT
        l.country_code,
        l.country_name,
        l.year,
        total_area_sq_mi*2.59 AS land_area_sqkm,
        forest_area_sqkm,
        (f.forest_area_sqkm/(total_area_sq_mi*2.59))*100 AS percentage,
        region
FROM land_area AS l
INNER JOIN forest_area AS f
ON f.country_code = l.country_code
AND f.year = l.year
INNER JOIN regions AS r
ON l.country_code = r.country_code);
```

2./*This query finds the forest area in the entire world in 1990*/

```
SELECT forest_area_sqkm
FROM forest_area
WHERE country_name = 'World'
AND year= 1990;
```

3./*This query finds the forest area in the entire world in 2016*/

```
SELECT forest_area_sqkm
FROM forest_area
```

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

4./*This query finds the total forest loss from 1990 to 2016.*/
SELECT a.forest_area_sqkm - b.forest_area_sqkm
FROM forest_area a
INNER JOIN forest_area b
ON a.country_name = b.country_name
AND a.year = 2016
AND b.year = 1990
WHERE a.country_name = 'World';

5.*This query finds the percentage forest loss from 1990 to 2016.*/
SELECT ROUND((((a.forest_area_sqkm -
b.forest_area_sqkm)*100)/b.forest_area_sqkm)::NUMERIC,1)
FROM forest_area a
INNER JOIN forest_area b
ON a.country_name = b.country_name
AND a.year = 2016
AND b.year = 1990
WHERE a.country_name = 'World';

6./*This query finds the country with land area equal to slightly less than the world's
deforestation from 1990-2016 (1324.45 sq km)*/
SELECT country_name,ROUND(land_area_sqkm::NUMERIC,2)
FROM forestation
WHERE land_area_sqkm < 1324449
AND year = 2016
ORDER BY land_area_sqkm DESC
—----------------------------------------------

7./*This query finds the forest percentage of the entire world in 2016.*/
SELECT ROUND(((SUM(forest_area_sqkm)/SUM(land_area_sqkm))*100)::NUMERIC,2) AS
wrd_percentage FROM forestation
WHERE country_name = 'World'
AND year = 2016;

8./*This query finds the region with the highest relative forestation in 2016.*/
```

```
SELECT ROUND((SUM(forest_area_sqkm)/SUM(land_area_sqkm)*100)::NUMERIC,2) AS
percentage, region
FROM forestation
GROUP BY region, year
HAVING year = 2016
ORDER BY percentage DESC;
```

9./*This query finds the region with the lowest relative forestation in 2016.*/

```
SELECT ROUND((SUM(forest_area_sqkm)/SUM(land_area_sqkm)*100)::NUMERIC,2) AS
percentage, region
FROM forestation
GROUP BY region, year
HAVING year = 2016
ORDER BY percentage;
```

10./*This query finds the forest percentage of the entire world in 1990.*/

```
SELECT ROUND(((SUM(forest_area_sqkm)/SUM(land_area_sqkm))*100)::NUMERIC,2) AS
wrd_percentage
FROM forestation
WHERE country_name = 'World'
AND year = 1990;
```

11./*This query finds the region with the highest relative forestation in 1990.*/

```
SELECT ROUND((SUM(forest_area_sqkm)/SUM(land_area_sqkm)*100)::NUMERIC,2) AS
percentage, region
FROM forestation
GROUP BY region, year
HAVING year = 1990
ORDER BY percentage DESC;
```

12./*This query finds the region with the lowest relative forestation in 1990.*/

```
SELECT ROUND((SUM(forest_area_sqkm)/SUM(land_area_sqkm)*100)::NUMERIC,2) AS
percentage, region
FROM forestation
GROUP BY region, year
HAVING year = 1990
ORDER BY percentage;
```

13./*This query shows all the regions and their relative forestation percentage in 2016 and 1990.*/

```
SELECT ROUND(((SUM(forest_area_sqkm)/SUM(land_area_sqkm))*100)::NUMERIC,2) AS
percentage, region, year
FROM forestation
GROUP BY region, year
HAVING year IN(2016, 1990)
ORDER BY region;

14./*This query shows the world's forestation percentage in 2016 and 1990.*/
SELECT ROUND(((SUM(forest_area_sqkm)/SUM(land_area_sqkm))*100)::NUMERIC,2) AS
percentage, region, year
FROM forestation
GROUP BY region, year
HAVING year IN(2016, 1990)
AND region = 'World';
—----------------------------
15./*This query shows the countries with the highest forest increase in terms of sq km between
1990 and 2016.*/
SELECT ROUND((a.forest_area_sqkm-b.forest_area_sqkm)::NUMERIC,2) AS subtract,
a.country_name
FROM forestation a
INNER JOIN forestation b
ON a.country_name=b.country_name
AND a.year = 2016
AND b.year = 1990
WHERE b.forest_area_sqkm IS NOT NULL
AND a.forest_area_sqkm IS NOT NULL
AND a.country_name <> 'World'
ORDER BY subtract DESC
LIMIT 5;

16./* This query shows the countries with the highest forest decrease in terms of percentage
between 1990 and 2016.*/
SELECT ROUND(((a.percentage - b.percentage)*100/ b.percentage)::NUMERIC,2) AS subtract,
a.country_name
FROM forestation a
INNER JOIN forestation b
ON a.country_name=b.country_name
AND a.year = 2016
AND b.year = 1990
WHERE b.percentage IS NOT NULL
```

```
AND a.percentage IS NOT NULL
AND a.country_name <> 'World'
ORDER BY subtract DESC
LIMIT 5;
```

17./*This query shows the countries with the highest forest decrease in terms of sq km between 1990 and 2016.*/

```
SELECT ROUND((a.forest_area_sqkm-b.forest_area_sqkm)::NUMERIC,2) AS subtract, a.country_name
FROM forestation a
INNER JOIN forestation b
ON a.country_name=b.country_name
AND a.year = 2016
AND b.year = 1990
WHERE b.forest_area_sqkm IS NOT NULL
AND a.forest_area_sqkm IS NOT NULL
AND a.country_name <> 'World'
ORDER BY subtract
LIMIT 5;
```

18./*This query shows the countries with the highest forest decrease in terms of percentage between 1990 and 2016.*/

```
SELECT ROUND(((a.percentage - b.percentage)*100/ b.percentage)::NUMERIC,2) AS subtract, a.country_name
FROM forestation a
INNER JOIN forestation b
ON a.country_name=b.country_name
AND a.year = 2016
AND b.year = 1990
WHERE b.percentage IS NOT NULL
AND a.percentage IS NOT NULL
AND a.country_name <> 'World'
ORDER BY subtract
LIMIT 5;
—----------------------------
```

19./*This query counts the number of countries in each quartile as for 2016.*/

```
SELECT
COUNT(CASE WHEN percentage < 25 THEN 1 END) AS first,
COUNT(CASE WHEN percentage BETWEEN 25 AND 50 THEN 2 END) AS
```

```
second,
COUNT(CASE WHEN percentage BETWEEN 50 AND 75  THEN 3 END) AS third,
COUNT(CASE WHEN percentage > 75 THEN 4 END) AS fourth
FROM forestation
WHERE year = 2016
AND country_name <> 'World';

20./*This query shows the countries with the highest forest percentage in 2016.*/
SELECT country_name, ROUND(percentage::NUMERIC,2), region
FROM forestation
WHERE year = 2016
AND percentage > 75
ORDER BY percentage DESC;
```