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 **3.31%**.

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** 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 & 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	46.16
Europe & Central Asia	37.28	38.04
North America	35.65	36.04
Sub-Saharan Africa	30.67	28.79
East Asia & Pacific	25.78	26.36
South Asia	16.51	17.51
Middle East & North Africa	1.77	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 **31.48**%.

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 **Iceland**

China and the **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
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 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%	73
50-75%	38
75-100%	9

The largest number of countries in 2016 were found in the **0-25%** 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

As a final comparison measure, the United States has approximately **33.93%** of its land to be designated as forest. There are 94 countries as of 2016 that have a higher forestation rate than the United States.

4. RECOMMENDATIONS

As an analyst for the ForestQuery team, I am deeply disturbed by these findings as we see that the majority of countries around the world have a relatively low forestation rate. This indicates that climate change and deforestation is real. Our primary focus should most definitely be on the countries in the Sub-Saharan Africa region of the world.

5. APPENDIX: SQL Queries Used

The following is a list of SQL queries used to provide the analysis seen above.

```
/* Please run the view creation code in the commented section below if you are
creating this table for the first time */

/*
DROP VIEW IF EXISTS forestation;

CREATE VIEW forestation
AS
SELECT f.country_name, f.country_code, f.year, f.forest_area_sqkm, (l.total_area_sq_mi
* 2.59) AS total_area_sqkm, (100.0 * f.forest_area_sqkm / (l.total_area_sq_mi * 2.59))
AS percent_land_area_as_forest, r.region, 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 f.country_code = r.country_code
ORDER BY f.country_code;
*/

/* Q 1-1 */
SELECT forest_area_sqkm
FROM forestation
WHERE region = 'World' AND year = 1990;

/* Q 1-2 */
SELECT forest_area_sqkm
FROM forestation
WHERE region = 'World' AND year = 2016;

/* Q 1-3 */
SELECT pp.forest_area_sqkm - p.forest_area_sqkm AS diff_forest_area_sqkm
FROM forest_area pp
JOIN forest_area p
ON pp.year = 1990 AND p.year = 2016
AND pp.country_name = 'World' AND p.country_name = 'World';
```

```sql
/* Q 1-4 */
SELECT 100.0*(pp.forest_area_sqkm - p.forest_area_sqkm) / p.forest_area_sqkm AS
diff_forest_area_sqkm
FROM forest_area pp
JOIN forest_area p
ON pp.year = 1990 AND p.year = 2016
AND pp.country_name = 'World' AND p.country_name = 'World';

/* Q 1-5 */
SELECT country_name, country_code, year, total_area_sqkm, ABS(total_area_sqkm -
(SELECT pp.forest_area_sqkm - p.forest_area_sqkm AS diff_forest_area_sqkm
FROM forest_area pp
JOIN forest_area p
ON pp.year = 1990 AND p.year = 2016
AND pp.country_name = 'World' AND p.country_name = 'World')
) AS diff
FROM forestation
WHERE year = 2016
ORDER BY diff
LIMIT 1;

/* Q 2-a1 */
SELECT region, 100.0 * SUM(forest_area_sqkm) / SUM(total_area_sqkm) AS
percent_forest_area, year
FROM forestation
WHERE region = 'World' AND year = 2016
GROUP BY region, year;

/* Q 2-a2 */
SELECT region, 100.0 * SUM(forest_area_sqkm) / SUM(total_area_sqkm) AS
percent_forest_area, year
FROM forestation
WHERE year = 2016
GROUP BY region, year
ORDER BY percent_forest_area DESC
LIMIT 1;

/* Q 2-a3 */
SELECT region, 100.0 * SUM(forest_area_sqkm) / SUM(total_area_sqkm) AS
percent_forest_area, year
FROM forestation
WHERE year = 2016
GROUP BY region, year
ORDER BY percent_forest_area
LIMIT 1;

/* Q 2-b1 */
```

```sql
SELECT region, 100.0 * SUM(forest_area_sqkm) / SUM(total_area_sqkm) AS
percent_forest_area, year
FROM forestation
WHERE region = 'World' AND year = 1990
GROUP BY region, year;

/* Q 2-b2 */
SELECT region, 100.0 * SUM(forest_area_sqkm) / SUM(total_area_sqkm) AS
percent_forest_area, year
FROM forestation
WHERE year = 1990
GROUP BY region, year
ORDER BY percent_forest_area DESC
LIMIT 1;

/* Q 2-b3 */
SELECT region, 100.0 * SUM(forest_area_sqkm) / SUM(total_area_sqkm) AS
percent_forest_area, year
FROM forestation
WHERE year = 1990
GROUP BY region, year
ORDER BY percent_forest_area
LIMIT 1;

/* Q 2-c */
SELECT q.region, 100.0 * SUM(q.forest_area_sqkm) / SUM(q.total_area_sqkm) AS
percent_forest_area_1990, 100.0 * SUM(qq.forest_area_sqkm) / SUM(qq.total_area_sqkm)
AS percent_forest_area_2016
FROM forestation q
JOIN forestation qq
ON q.year = 1990 AND qq.year = 2016 AND q.region = qq.region
GROUP BY q.region, q.year
ORDER BY percent_forest_area_1990 DESC;

/* Q 3-a */
SELECT q.country_name, q.forest_area_sqkm AS forest_area_sqkm_1990,
qq.forest_area_sqkm AS forest_area_sqkm_2016, qq.forest_area_sqkm - q.forest_area_sqkm
AS diff
FROM forestation q
JOIN forestation qq
ON q.year = 1990 AND qq.year = 2016 AND q.country_name = qq.country_name
WHERE qq.forest_area_sqkm - q.forest_area_sqkm IS NOT NULL
ORDER BY diff DESC;

/* Q 3-a continued - largest concerns */
SELECT q.country_name, q.region, q.forest_area_sqkm AS forest_area_sqkm_1990,
qq.forest_area_sqkm AS forest_area_sqkm_2016, qq.forest_area_sqkm - q.forest_area_sqkm
AS diff
```

```sql
FROM forestation q
JOIN forestation qq
ON q.year = 1990 AND qq.year = 2016 AND q.country_name = qq.country_name
WHERE qq.forest_area_sqkm - q.forest_area_sqkm IS NOT NULL AND q.country_name !=
'World'
ORDER BY diff
LIMIT 5;

/* Q 3-b */
SELECT q.country_name, q.forest_area_sqkm AS forest_area_sqkm_1990,
qq.forest_area_sqkm AS forest_area_sqkm_2016, 100.0*(qq.forest_area_sqkm -
q.forest_area_sqkm) / q.forest_area_sqkm AS diff
FROM forestation q
JOIN forestation qq
ON q.year = 1990 AND qq.year = 2016 AND q.country_name = qq.country_name
WHERE qq.forest_area_sqkm - q.forest_area_sqkm IS NOT NULL
ORDER BY diff DESC;

/* Q 3-b continued - biggest concerns */
SELECT q.country_name, q.region, q.forest_area_sqkm AS forest_area_sqkm_1990,
qq.forest_area_sqkm AS forest_area_sqkm_2016, 100.0*(qq.forest_area_sqkm -
q.forest_area_sqkm) / q.forest_area_sqkm AS diff
FROM forestation q
JOIN forestation qq
ON q.year = 1990 AND qq.year = 2016 AND q.country_name = qq.country_name
WHERE qq.forest_area_sqkm - q.forest_area_sqkm IS NOT NULL
ORDER BY diff
LIMIT 5;

/* Q 3-c */
SELECT quartiles, COUNT(*) as num_countries
FROM (
SELECT country_name, percent_land_area_as_forest,
CASE WHEN percent_land_area_as_forest <= 25 THEN '0-25%'
WHEN percent_land_area_as_forest > 25 AND percent_land_area_as_forest <= 50 THEN '25-
50%'
WHEN percent_land_area_as_forest > 50 AND percent_land_area_as_forest <= 75 THEN '50-
75%'
ELSE '75-100%' END AS quartiles
FROM forestation
WHERE year = 2016 AND percent_land_area_as_forest IS NOT NULL) AS q
GROUP BY quartiles
ORDER BY quartiles;

/* Q 3-d */
SELECT country_name, region, percent_land_area_as_forest
FROM (
SELECT country_name, region, percent_land_area_as_forest,
```

```sql
CASE WHEN percent_land_area_as_forest <= 25 THEN '0-25%'
WHEN percent_land_area_as_forest > 25 AND percent_land_area_as_forest <= 50 THEN '25-
50%'
WHEN percent_land_area_as_forest > 50 AND percent_land_area_as_forest <= 75 THEN '50-
75%'
ELSE '75-100%' END AS quartiles
FROM forestation
WHERE year = 2016 AND percent_land_area_as_forest IS NOT NULL) AS q
WHERE quartiles = '75-100%'
ORDER BY percent_land_area_as_forest DESC;

/* Q 3-e */
SELECT COUNT (*)
FROM (
SELECT country_name, percent_land_area_as_forest
FROM forestation
WHERE percent_land_area_as_forest >
    (SELECT percent_land_area_as_forest as usa
    FROM forestation
    WHERE country_name = 'United States' AND year = 2016)
    AND year = 2016) as q;
```