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 3.2082425898024405 %.

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	46.16
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	1.78	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 527229.06. 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 79200.00, much lower than the figure for Iceland.

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	-541510.00
Indonesia	East Asia & Pacific	-282193.98
Myanmar	East Asia & Pacific	-107234.00
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	-59.13
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, 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	98.2576939676578
Micronesia, Fed. Sts.	East Asia & Pacific	91.85723907152479
Gabon	Sub-Saharan Africa	90.0376418700565
Seychelles	Sub-Saharan Africa	88.41113673857889
Palau	East Asia & Pacific	87.60680854912036
American Samoa	East Asia & Pacific	87.5000875000875
Guyana	Latin America & Caribbean	83.90144891106817
Lao PDR	East Asia & Pacific	82.10823176408609
Solomon Islands	East Asia & Pacific	77.86351779450665

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?*

The World Bank data reveals significant disparities in forest cover trends across regions, with Latin America, Southeast Asia, and Central Africa experiencing notable declines in forest area. Specifically, regions like Sub-Saharan Africa and Latin America are critical areas where targeted attention is needed due to their substantial loss of forest cover.

5. APPENDIX: SQL Queries Used

```
-- CREATE VIEW forestation joining all three tables
CREATE VIEW forestation AS
    SELECT f.country_code,
           f.country_name,
           f.year,
           f.forest_area_sqkm,
           l.total_area_sq_mi,
           l.total_area_sq_mi * 2.59 AS total_area_sqkm,
           (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 as
forest_percentage,
           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 r.country_code = f.country_code;


-- 1.GLOBAL SITUATION
--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(forest_area_sqkm)
FROM forestation
WHERE year = '1990' AND 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(forest_area_sqkm)
FROM forestation
WHERE year = '2016' AND region='World'
```

```sql
--c. What was the change (in sq km) in the forest area of the world from 1990 to
2016?
SELECT (f1.forest_area_sqkm - f2.forest_area_sqkm) AS forest_area_loss
FROM forestation f1 , forestation f2
WHERE f1.year = '1990' AND
f1.region='World' AND
f2.year = '2016' AND
f2.region='World'

--d. What was the percent change in forest area of the world between 1990 and
2016?
SELECT (f1.forest_area_sqkm - f2.forest_area_sqkm)*100/f1.forest_area_sqkm AS
forest_area_loss
FROM forestation f1 , forestation f2
WHERE f1.year = '1990' AND
f1.region='World' AND
f2.year = '2016' AND
f2.region='World'

--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 < (
    SELECT (f1.forest_area_sqkm - f2.forest_area_sqkm) AS forest_area_loss
    FROM forestation f1
    JOIN forestation f2
    ON f1.region = f2.region
    WHERE f1.year = '1990'
    AND f1.region = 'World'
    AND f2.year = '2016'
    AND f2.region = 'World'
)
ORDER BY total_area_sqkm DESC
LIMIT 1;

-- 2.Regional Outlook
--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
    region,
```

```
    year,
    ROUND(CAST(forest_percentage AS NUMERIC), 2) as forest_percentage
FROM forestation
WHERE year = 2016
AND region = 'World';

SELECT
    region,
    ROUND(CAST((SUM(forest_area_sqkm)/SUM(total_area_sqkm)*100) AS NUMERIC), 2)
as forest_percentage
FROM forestation
WHERE year = 2016
AND region != 'World'
GROUP BY region
ORDER BY forest_percentage DESC
LIMIT 1;

SELECT
    region,
    ROUND(CAST((SUM(forest_area_sqkm)/SUM(total_area_sqkm)*100) AS NUMERIC), 2)
as forest_percentage
FROM forestation
WHERE year = 2016
AND region != 'World'
GROUP BY region
ORDER BY forest_percentage ASC
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
    region,
    year,
    ROUND(CAST(forest_percentage AS NUMERIC), 2) as forest_percentage
FROM forestation
WHERE year = 1990
AND region = 'World';

SELECT
    region,
    ROUND(CAST((SUM(forest_area_sqkm)/SUM(total_area_sqkm)*100) AS NUMERIC), 2)
as forest_percentage
FROM forestation
WHERE year = 1990
AND region != 'World'
```

```sql
GROUP BY region
ORDER BY forest_percentage DESC
LIMIT 1;

SELECT
    region,
    ROUND(CAST((SUM(forest_area_sqkm)/SUM(total_area_sqkm)*100) AS NUMERIC), 2)
as forest_percentage
FROM forestation
WHERE year = 1990
AND region != 'World'
GROUP BY region
ORDER BY forest_percentage ASC
LIMIT 1;
--c. Based on the table you created, which regions of the world DECREASED in
forest area from 1990 to 2016?
SELECT
    region,
    ROUND(CAST((SUM(CASE WHEN year = 1990 THEN forest_area_sqkm END)/
                SUM(CASE WHEN year = 1990 THEN total_area_sqkm END)*100) AS
NUMERIC), 2) as forest_percentage_1990,
    ROUND(CAST((SUM(CASE WHEN year = 2016 THEN forest_area_sqkm END)/
                SUM(CASE WHEN year = 2016 THEN total_area_sqkm END)*100) AS
NUMERIC), 2) as forest_percentage_2016
FROM forestation
WHERE year IN (1990, 2016)
AND region != 'World'
GROUP BY region
ORDER BY forest_percentage_1990 DESC;

SELECT
    region,
    ROUND(CAST((SUM(CASE WHEN year = 1990 THEN forest_area_sqkm END)/
                SUM(CASE WHEN year = 1990 THEN total_area_sqkm END)*100) AS
NUMERIC), 2) as forest_percentage_1990,
    ROUND(CAST((SUM(CASE WHEN year = 2016 THEN forest_area_sqkm END)/
                SUM(CASE WHEN year = 2016 THEN total_area_sqkm END)*100) AS
NUMERIC), 2) as forest_percentage_2016
FROM forestation
WHERE year IN (1990, 2016)
AND region = 'World'
GROUP BY region
ORDER BY forest_percentage_1990 DESC;

-- 3.Country-Level Detail
```

```sql
-- A.SUCCESS STORIES
SELECT f2.country_name,
  ROUND(CAST(f1.forest_area_sqkm - f2.forest_area_sqkm  AS NUMERIC),2) AS
difference
FROM forest_area AS f1
JOIN forest_area AS f2
  ON  (f1.year = '2016' AND f2.year = '1990')
  AND f1.country_name = f2.country_name
ORDER BY difference DESC;

SELECT f2.country_name,
  ROUND(CAST((f1.forest_area_sqkm - f2.forest_area_sqkm)/f2.forest_area_sqkm
*100  AS NUMERIC),2) AS percentage
FROM forest_area AS f1
JOIN forest_area AS f2
  ON  (f1.year = '2016' AND f2.year = '1990')
  AND f1.country_name = f2.country_name
ORDER BY percentage DESC;

-- B.LARGEST CONCERNS
SELECT f2.country_name,  f2.region,
  ROUND(CAST(f1.forest_area_sqkm - f2.forest_area_sqkm  AS NUMERIC),2) AS
area_change
FROM forestation AS f1
JOIN forestation AS f2
  ON  (f1.year = '2016' AND f2.year = '1990')
  AND f1.country_name = f2.country_name
  WHERE f2.country_name != 'World'
ORDER BY area_change ASC
LIMIT 5;

SELECT f2.country_name, f2.region,
  ROUND(CAST((f1.forest_area_sqkm - f2.forest_area_sqkm)/f2.forest_area_sqkm
*100  AS NUMERIC),2) AS percentage
FROM forestation AS f1
JOIN forestation AS f2
  ON  (f1.year = '2016' AND f2.year = '1990')
  AND f1.country_name = f2.country_name
ORDER BY percentage ASC
LIMIT 5;

--C.QUARTILES
SELECT distinct(quartiles), COUNT(country_name) OVER (PARTITION BY quartiles)
FROM (SELECT country_name,
  CASE WHEN forest_percentage <= 25 THEN '0-25%'
```

```sql
  WHEN forest_percentage <= 75 AND forest_percentage > 50 THEN '50-75%'
  WHEN forest_percentage <= 50 AND forest_percentage > 25 THEN '25-50%'
  ELSE '75-100%'
END AS quartiles FROM forestation
WHERE forest_percentage IS NOT NULL AND year = 2016) quart;

SELECT country_name, region ,forest_percentage
FROM forestation
WHERE forest_percentage > 75 AND year = 2016
ORDER BY forest_percentage DESC;
```