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 **41,282,694.9 sqkm** in 1990. As of 2016 **39,958,245.9 sqkm**, the most recent year for which data was available, that number had fallen to, a loss of **1,324,449 sqkm**, 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 **1,279,999.9891 sqkm**).

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
Middle East & North Africa	1.78%	2.07%
South Asia	16.51%	17.51%
East Asia & Pacific	25.78%	26.36%
Sub-Saharan Africa	30.67%	28.79%
World	32.42%	31.38%
North America	35.65%	36.04%
Europe & Central Asia	37.28%	38.04%
Latin America & Caribbean	51.03%	46.16%

The only regions of the world that decreased in percent forest area from 1990 to 2016 were **Latin America & Caribbean** (dropped from **51.02**% **to 46.16%)** and **Sub-Saharan Africa** (**30.67% to 28.78%).** 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 31.37%**

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 **527,229.062 sqkm**. 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 sqkm**, 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 **Brazil, Indonesia and Myanmar** 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	541,510.00 sqkm
Indonesia	East Asia & Pacific	282,193.98 sqkm
Myanmar	East Asia & Pacific	107,234.00 sqkm
Nigeria	Sub-Sahara Africa	106,506.00 sqkm
Tanzania	Sub-Sahara Africa	102,320.00 sqkm

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	47.50%
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 **Togo, Nigeria, Uganda, 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%	72
50-75%	38
75-100%	9

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

There were **85** 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%

5. RECOMMENDATIONS

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

What have you learned from the World Bank data?

- The world forest area in fact is decreasing throughout the years. From 1990 to 2016 the lost forest area represents a 3.21% that is equal to the entire land area of Peru. So, we have to approach different regions and countries that have a higher lost in percentage and forest area.

- The main focus are the regions Latin America and Caribbean, and Sub-Saharan Africa since they have been losing in percent forest area from 1990 to 2016 were **Latin America & Caribbean** (dropped from **51.02**% **to 46.16%)** and **Sub-Saharan Africa** (**30.67% to 28.78%),** impacting the world forest land.

- Nigeria is the most critical country, since it has decreased the forest area in land and percentage from 1990 to 2016, so we have to Take measures in this country primarily.

- Countries like China, United States and Iceland are increasing their forest area. I recommend digging deeper and analyze which measures or environmental protection policies these countries are implementing to stop the deforestation levels and increase their forest area.

- Focus on Countries like Togo, Nigeria, Uganda, Mauritania, and Honduras which their forest area have decreased in more than 40%.

- It is important to have in observation countries like Brazil, Indonesia, Myanmar, Nigeria, and Tanzania since these countries have been losing a significant amount of forest area but since some of them like Brazil have an extended land area, the percentage of lost is not alarming.

- Protect those countries that have a high percentage of their land area designated as forest as Suriname in Latin America & Caribbean region with a 98.26%.

6. APPENDIX

1. VIEW

```
DROP
  VIEW IF EXISTS forestation;
CREATE VIEW forestation AS
```

```
SELECT
  f.country_code AS country_code,
  f.country_name AS country_name,
  r.region,
  f.year AS year,
  f.forest_area_sqkm,
  r.income_group,
  (l.total_area_sq_mi * 2.59) AS total_area_sqkm,
  ROUND(
    (
      f.forest_area_sqkm /(l.total_area_sq_mi * 2.59) * 100
    ):: numeric,
    2
  ) AS percent_forest_area
FROM
  forest_area AS f
  JOIN land_area AS l ON f.country_code = l.country_code
  AND f.year = l.year
  JOIN regions AS r ON l.country_code = r.country_code
```

2. GLOBAL SITUATION

```
WITH total_area_90 AS (
  SELECT
    region,
    forest_area_sqkm
  FROM
    forestation
  WHERE
    region = 'World'
    AND year = 1990
),
total_area_2016 AS (
  SELECT
    region,
    forest_area_sqkm
  FROM
    forestation
  WHERE
    region = 'World'
    AND year = 2016
)
SELECT
```

```
  total_area_90.region,
  total_area_90.forest_area_sqkm AS total_forest_90,
  total_area_2016.forest_area_sqkm AS total_forest_2016,
  (
    total_area_90.forest_area_sqkm - total_area_2016.forest_area_sqkm
  ) AS deforest,
  ROUND(
    (
      (
        total_area_90.forest_area_sqkm - total_area_2016.forest_area_sqkm
      )/ total_area_90.forest_area_sqkm * 100
    ):: NUMERIC,
    2
  ) AS percentage
FROM
  total_area_90
  JOIN total_area_2016 ON total_area_90.region = total_area_2016.region
```

PERU IN 2016

```
SELECT
  *
FROM
  forestation
WHERE
  year = 2016
  AND total_area_sqkm <= 1324449
ORDER BY
  total_area_sqkm DESC
LIMIT
  1
```

3. REGIONAL OUTLOOK

World 1990

```
SELECT
  region,
  total_area_sqkm,
  ROUND(percent_forest_area :: numeric, 2)
FROM
  forestation
WHERE
```

```
  region = 'World'
  AND year = 1990
```

World 2016

```
SELECT
  region,
  total_area_sqkm,
  ROUND(percent_forest_area :: numeric, 2)
FROM
  forestation
WHERE
  region = 'World'
  AND year = 2016
```

Percent Forest area by region 1990, 2016

```
WITH t1 AS (
  SELECT
    region,
    SUM(forest_area_sqkm) AS max_forests_1990,
    SUM(forest_area_sqkm) * 100 / SUM(total_area_sqkm) AS percentage_1990
  FROM
    forestation
  WHERE
    year = 1990
  GROUP BY
    1
  HAVING
    SUM(forest_area_sqkm) IS NOT NULL
),
t2 AS (
  SELECT
    region,
    SUM(forest_area_sqkm) AS max_forests_2016,
    SUM(forest_area_sqkm) * 100 / SUM(total_area_sqkm) AS percentage_2016
  FROM
    forestation
  WHERE
    year = 2016
  GROUP BY
    1
  HAVING
    SUM(forest_area_sqkm) IS NOT NULL
```

```
)
SELECT
  t1.region AS region,
  ROUND(t1.percentage_1990 :: NUMERIC, 2) AS percentage_1990,
  ROUND(t2.percentage_2016 :: NUMERIC, 2) AS percentage_2016,
  ROUND(
    (
      t2.percentage_2016 - t1.percentage_1990
    ):: NUMERIC,
    2
  ) AS forest_difference_percent
FROM
  t1
  JOIN t2 ON t1.region = t2.region
ORDER BY
  2,
  3
```

4.COUNTRY-LEVEL DETAIL

Success Stories

```
WITH t1 AS (
  SELECT
    country_name,
    forest_area_sqkm AS forests_1990,
    percent_forest_area AS percentage_1990
  FROM
    forestation
  WHERE
    year = 1990
),
t2 AS (
  SELECT
    country_name,
    forest_area_sqkm AS forests_2016,
    percent_forest_area AS percentage_2016
  FROM
    forestation
  WHERE
    year = 2016
)
SELECT
```

```
  t1.country_name AS country_name,
  ROUND(
    (
      t2.forests_2016 - t1.forests_1990
    ):: NUMERIC,
    2
  ) AS increase_area
FROM
  t1
  JOIN t2 ON t1.country_name = t2.country_name
WHERE
  forests_2016 > forests_1990
ORDER BY
  2 DESC
```

Iceland increase

```
WITH t1 AS (
  SELECT
    country_name,
    region,
    forest_area_sqkm AS forests_1990,
    percent_forest_area AS percentage_1990
  FROM
    forestation
  WHERE
    year = 1990
),
t2 AS (
  SELECT
    country_name,
    forest_area_sqkm AS forests_2016,
    percent_forest_area AS percentage_2016
  FROM
    forestation
  WHERE
    year = 2016
)
SELECT
  t1.country_name,
  ROUND(
    (
      (
        percentage_2016 - percentage_1990
```

```
      ) / percentage_1990 * 100
    ):: NUMERIC,
    2
  ) AS percent_increase
FROM
  t1
  JOIN t2 ON t1.country_name = t2.country_name
WHERE
  percentage_2016 > percentage_1990
ORDER BY
  2 DESC
LIMIT
  1
```

5.LARGEST CONCERNS

Top 5 amount decrease in forest area by country 1990 & 2016

```
WITH t1 AS (
  SELECT
    country_name,
    region,
    forest_area_sqkm AS forests_1990,
    percent_forest_area AS percentage_1990
  FROM
    forestation
  WHERE
    year = 1990
),
t2 AS (
  SELECT
    country_name,
    forest_area_sqkm AS forests_2016,
    percent_forest_area AS percentage_2016
  FROM
    forestation
  WHERE
    year = 2016
)
SELECT
  t1.country_name AS country_name,
  t1.region,
  ROUND(
```

```
    (
      t1.forests_1990 - t2.forests_2016
    ):: NUMERIC,
    2
  ) AS decrease_area
FROM
  t1
  JOIN t2 ON t1.country_name = t2.country_name
WHERE
  forests_2016 < forests_1990
  AND t1.country_name != 'World'
ORDER BY
  3 DESC
LIMIT
  5
```

Top 5 percent decrease in forest area by country

```
WITH t1 AS (
  SELECT
    country_name,
    region,
    forest_area_sqkm AS forests_1990,
    percent_forest_area AS percentage_1990
  FROM
    forestation
  WHERE
    year = 1990
),
t2 AS (
  SELECT
    country_name,
    forest_area_sqkm AS forests_2016,
    percent_forest_area AS percentage_2016
  FROM
    forestation
  WHERE
    year = 2016
)
SELECT
  t1.country_name,
  t1.region,
  ROUND(
    (
```

```
      (
        percentage_1990 - percentage_2016
      ) / percentage_1990 * 100
    ):: NUMERIC,
    2
  ) AS percent_decrease
FROM
  t1
  JOIN t2 ON t1.country_name = t2.country_name
WHERE
  percentage_2016 < percentage_1990
ORDER BY
  3 DESC
LIMIT
  5
```

6.QUARTILES 2016

```
SELECT
  CASE WHEN percent_forest_area < 25 THEN '0-25%' WHEN percent_forest_area >= 25
  AND percent_forest_area <= 50 THEN '25-50%' WHEN percent_forest_area >= 50
  AND percent_forest_area <= 75 THEN '50 - 75%' ELSE '75-100%' END AS quartile,
  COUNT(country_name)
FROM
  forestation
WHERE
  year = 2016
  AND percent_forest_area IS NOT NULL
  AND region != 'World'
GROUP BY
  1
ORDER BY
  1
```

Countries in the top quartile

```
SELECT
  country_name,
  percent_forest_area,
  region
FROM
  (
    SELECT
      CASE WHEN percent_forest_area < 25 THEN '0-25%' WHEN percent_forest_area >= 25
```

```
    AND percent_forest_area <= 50 THEN '25-50%' WHEN percent_forest_area >= 50
    AND percent_forest_area <= 75 THEN '50 - 75%' ELSE '75-100%' END AS quartile,
    country_name,
    percent_forest_area,
    region,
    COUNT(country_name)
  FROM
    forestation
  WHERE
    year = 2016
    AND percent_forest_area IS NOT NULL
  GROUP BY
    1,
    2,
    3,
    4
 ) quartile_table
WHERE
 quartile_table.quartile = '75-100%'
ORDER BY
 2 DESC
```