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 __132449__, 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 _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 American & Caribbean__, with _46.14_%, 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 American & Caribbean_, with _51.08_%, and the region with the lowest relative forestation was _North American_, with _35.66_% 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%
Sub-Saharan Africa	30.67%	28.79%
Latin America & Caribbean	51.67%	46.79%
World	32.42%	31.38%
South Asia	16.53%	17.50%
Europe & Central Asia	37.20%	38.07%
East Asia & Pacific	25.78%	26.36%
North America	35.66%	36.02%

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__ (__51.67_% to __46.79___%). 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__China__. This country actually increased in forest area from 1990 to 2016 by _14235184.674_. 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 __2138400__, 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	14620770
Indonesia	East Asia & Pacific	7619237.57880001
Myanmar	East Asia & Pacific	2895318.1053
Nigeria	Sub-Saharan Africa	2875662.02646
Tanzania	Sub-Saharan Africa	2762640

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	84
25-50	74
50-75	38
75-100	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	659.12243
Micronesia	East Asia & Pacific	616.18754515695
Gabon	Sub-Saharan Africa	603.981505428526
Seychelles	Sub-Saharan & Pacific	593.070746356061
Palau	East Asia & Pacific	587.6752323428354

5. 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?*

From the data analysis team at ForestQuery has obtained data from the World Bank we can see the forest area changes from all the different countries total land between the 1990 and 2016. The World Bank, the total forest area has had a loss of 3.21% of land over all. Even though it shows the most gain forest area for China, that should be a surprise with how big China is. Compared to Iceland who also had an increase, who although had less land increase in forest area, the percentage was much higher at 213.66%. As you can see you can look at the amount of land change or the amount of percentage change you will get different results, although Nigeria is in the top 5 results for both analyses. They will hopefully stop to decline and efforts start to pay off. I believe the other countries that need to start focusing on change are Togo, Uganda, Mauritania, And Honduras.

Appendix

```
--CREATING NEW TABLE JOINING ALL THREE TABLES AND CREATING NEW COLUMN COMBINING THE
FOREST AREA AND TOTAL AREA
DROP VIEW IF EXISTS forestation;
CREATE VIEW forestation
AS
SELECT fa.country_code AS code,
    fa.country_name AS name,
    fa.year AS year,
    fa.forest_area_sqkm AS forest_area,
```

```
    la.total_area_sq_mi AS total_area,
    r.region AS region,
        r.income_group AS income,
   (fa.forest_area_sqkm/la.total_area_sq_mi*2.59)*100 AS combined_area
FROM forest_area fa
JOIN land_area la
ON fa.country_code = la.country_code
JOIN regions r
ON fa.country_code = r.country_code;

--According to the World Bank, the total forest area of the world was _____ in 1990. As of 2016, the most recent year for which data was available, that number had fallen to _____, a loss of _____, or _____%.
SELECT forest_area
FROM forestation
WHERE name = 'World' and year = '1990'
GROUP BY forest_area;
--41282694.9
SELECT forest_area
FROM forestation
WHERE name = 'World' and year = '2016'
GROUP BY forest_area;
--39958245.9

SELECT (
 (SELECT forest_area
  FROM forestation
  WHERE name = 'World' and year = '1990'
  GROUP BY forest_area)-(
  SELECT forest_area
  FROM forestation
  WHERE name = 'World' and year = '2016'
  GROUP BY forest_area)) AS difference;
--1324449

SELECT (((
        (SELECT SUM(forest_area) total_area
        FROM Forestation
        WHERE YEAR = 1990
        AND name = 'World') -
        (SELECT SUM(forest_area) total_area
        FROM forestation
        WHERE YEAR = 2016
        AND name = 'World')) / (
        (SELECT SUM(forest_area) total_area
        FROM forestation
        WHERE YEAR = 1990
        AND name = 'World'))) *100) AS Percent_decrease;
--3.21
```

--The forest area lost over this period of time is slightly more than the entire land are _____, listed for the year 2016 which is ____

```
SELECT name,
       total_area * 2.59 total_area
FROM Forestation
WHERE YEAR = 2016
      AND total_area IS NOT NULL
  AND total_area * 2.59 <= 1324449
GROUP BY name,
         total_area
ORDER BY total_area DESC
LIMIT 1;
```

--- Peru---1279999.9891

--In 2016, the percent of the total land area of the world designated as forest was _____. The region with the highest relative forestation was_____, with _____%, and the region with the lowest relative forestation was _____, with _____% forestation.

```
SELECT name,
    Round(((SUM(forest_area) / SUM(total_area*2.59))*100)::numeric,        2) AS percent
FROM Forestation
WHERE year = 2016
      AND name = 'World'
GROUP BY name;
```

---31.38%

```
SELECT region,
    round(((SUM(forest_area) / SUM(total_area*2.59))*100)::numeric,        2) AS percent
FROM forestation
WHERE year = 2016
GROUP BY region
ORDER BY percent DESC;
```

--- Latin America & Caribbean with 46.14%

```
SELECT region,
    round(((SUM(forest_area) / SUM(total_area*2.59))*100)::numeric,        2) AS percent
FROM forestation
WHERE year = 2016
GROUP BY region
ORDER BY percent ASC;
```

---Middle East & North Africa with 2.07%

---In 1990, the percent of the total land area of the world designated as forest was _____. The region with the highest relative forestation was_____, with _____%, and the region with the lowest relative forestation was _____, with _____% forestation.

```
SELECT name,
       Round(((SUM(forest_area)/SUM(total_area*2.59))*100)::numeric,2)  AS percent
FROM forestation
WHERE year = 1990
```

```
        AND name = 'World'
GROUP BY name;
---World ---32.42%

SELECT region,
            Round(((SUM(forest_area)/SUM(total_area*2.59))*100)::numeric,2)      AS percent
FROM forestation
WHERE year = 1990
GROUP BY region;
--- Latin America & Caribbean with 51.08%
--- North America with 35.66%



--Region
--1990 Forest Percentage
--2016 Forest Percentage
--The only regions of the world that decreased in percent forest area from 1990 to 2016 were _____
(dropped from _____% to _____%) and _____
(_____% to _____%). 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 _____% to _____%.
WITH y90 AS(
  SELECT region,
 Round(((Sum(forest_area) / Sum(total_area*2.59))*100)::Numeric, 2) AS
percent_forest_90
FROM Forestation
WHERE year = '1990'
GROUP BY region
ORDER BY percent_forest_90),
y16 AS(
 SELECT region,
 Round(((Sum(forest_area) / Sum(total_area*2.59))*100)::Numeric, 2) AS
percent_forest_16
FROM Forestation
WHERE year = '2016'
GROUP BY region
ORDER BY percent_forest_16)

SELECT f.region,
            a.percent_forest_90,
      b.percent_forest_16
FROM forestation f
JOIN y90 a
ON f.region = a.region
JOIN y16 b
ON f.region = b.region
GROUP BY f.region, a.percent_forest_90, b.percent_forest_16;
---Sub-Saharan Africa --30.67% --28.70%
---Latin America & Caribbean --51.08% --46.14%
```

---World --32.42% --31.38%

--There is one particularly bright spot in the data at the country level, _____. This country actually increased in forest area from 1990 to 2016 by _____. 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_____, but it only saw an increase of _____, much lower than the figure for _____.

```
WITH y90 AS
(SELECT name,
SUM(forest_area) forest_90
FROM forestation
WHERE YEAR = 1990
GROUP BY name,
forest_area),
y16 AS
(SELECT name,
SUM(forest_area) forest_16
FROM forestation
WHERE YEAR = 2016
GROUP BY name,
forest_area)
SELECT a.name,
(a.forest_90 - b.forest_16) forest_change
FROM y90 a
JOIN y16 b
ON a.name = b.name
ORDER BY forest_change
LIMIT 2;
```

---China ---14235184.674
---United States ----2138400

--_____ and _____ 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. _____ increased in forest area by _____% from 1990 to 2016.

```
WITH y90 AS
(SELECT name,
(SUM(forest_area) / SUM(total_area*2.59))*100 AS forest_90
FROM forestation
WHERE YEAR = 1990
GROUP BY name,
forest_area),
y16 AS
(SELECT name,
(SUM(forest_area) / SUM(total_area*2.59))*100 AS forest_16
FROM forestation
WHERE YEAR = 2016
GROUP BY name,
```

```
 forest_area)
SELECT a.name,
 Round((((a.forest_90 -
b.forest_16)/(a.forest_90))*100)::Numeric, 2) percent_change
FROM y90 a
JOIN y16 b
ON a.name = b.name
ORDER BY percent_change;
---China
---United States
---Iceland
---213.66


---•        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
WITH y90 AS
 (SELECT name,
                        region,
                        SUM(forest_area) AS forest_90
 FROM forestation
 WHERE YEAR = 1990
 GROUP BY name,
                         region,
        forest_area),
 y16 AS
 (SELECT name,
                       region,
                       SUM(forest_area) AS forest_16
 FROM forestation
 WHERE YEAR = 2016
 GROUP BY name,
        region,
                         forest_area)
SELECT a.name,
              a.region,
 (a.forest_90 - b.forest_16) AS change
FROM y90 a
JOIN y16 b
ON a.name = b.name
WHERE a.forest_90 IS NOT NULL
AND b.forest_16 IS NOT NULL
AND a.name != 'World'
ORDER BY change DESC
```

```
LIMIT 5;
```
---Brazil --Latin America & Caribbean -- 14620770
---Indonesia -- East Asia & Pacific -- 7619237.57880001
---Myanmar -- East Asia & Pacific -- 2895318.1053
---Nigeria -- Sub-Saharan Africa -- 2875662.02646
---Tanzania -- Sub-Saharan Africa --2762640

----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

```
WITH y90 AS
 (SELECT name,
                        region,
 (SUM(forest_area) / SUM(total_area*2.59))*100 AS forest_90
 FROM forestation
 WHERE YEAR = 1990
 GROUP BY name,
        region,
                         forest_area),
 y16 AS
 (SELECT name,
                        region,
 (SUM(forest_area) / SUM(total_area*2.59))*100 AS forest_16
 FROM forestation
 WHERE YEAR = 2016
 GROUP BY name,
                         region,
        forest_area)
SELECT a.name,
              a.region,
              Round((((a.forest_90-b.forest_16)/(a.forest_90))*100)::Numeric,                    2) percent_change
FROM y90 a
JOIN y16 b
ON a.name = b.name
WHERE a.forest_90 IS NOT NULL
AND b.forest_16 IS NOT NULL
AND a.name != 'World'
ORDER BY percent_change DESC
LIMIT 5;
```

---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
---Sub-Saharan Afria
---Togo, Nigeria, Uganda, Mauritania
---Honduras -- Latin America & Caribbean

---Table 3.3: Count of Countries Grouped by Forestation Percent Quartiles, 2016:
---The largest number of countries in 2016 were found in the _____ quartile.
---There were _____ 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.

```
WITH t1 AS
 (SELECT name,
                        YEAR,
 (SUM(forest_area) / SUM(total_area*2.59))*100 percent_forest
 FROM forestation
 WHERE YEAR = 2016
 GROUP BY name,
         YEAR,
                         forest_area)
SELECT Distinct(quartiles),
              COUNT(name)Over(PARTITION BY quartiles)
FROM
 (SELECT name,
                        CASE
                        WHEN percent_forest<25 THEN '0-25'
                        WHEN percent_forest>=25
                        AND percent_forest<50 THEN '25-50'
                        WHEN percent_forest>=50
                        AND percent_forest<75 THEN '50-75'
                        ELSE '75-100'
                        END AS quartiles
 FROM t1
 WHERE percent_forest IS NOT NULL
 AND YEAR = 2016) sub;
  ---0-25 -- 84
  ---25-50 -- 74
  ---50-75 -- 38
  ---75-100 -- 9
  ---first -- 9


  ---Table 3.4: Top Quartile Countries, 2016
SELECT name,
              region,
       combined_area
FROM forestation
WHERE combined_area >= 75
  AND year = 2016
GROUP BY name,
                        region,
                        combined_area
ORDER BY combined_area DESC;
```

```
SELECT name,
                total_area * 2.59 total_area
FROM Forestation
WHERE YEAR = 2016
             AND total_area IS NOT NULL
    AND total_area * 2.59 <= 1324449
GROUP BY name,
                  total_area
ORDER BY total_area DESC
LIMIT 1;
```