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 sqkm in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39958245.9 sqkm, a loss of _1324449 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 _1279999.99_sqkm_).

2. **REGIONAL OUTLOOK**

In 2016, the percent of the total land area of the world designated as forest was 27.55%. 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 2.06_ % forestation.

In 1990, the percent of the total land area of the world designated as forest was _28.46% . The region with the highest relative forestation was___Latin America & Caribbean_, with __51.02_ %, and the region with the lowest relative forestation was ____Middle East & North Africa_, with 1.77% forestation.

Table 2.1: Percent Forest Area by Region, 1990 & 2016:

Region	1990 Forest Percentage	2016 Forest Percentage
Latin America & Caribbean	51.02 %	46.16 %
Europe & Central Asia	37.28 %	38.04 %
North America	35.65 %	36.03 %
World	32.42 %	31.37 %
Sub-Saharan Africa	30.67 %	28.78 %
East Asia & Pacific	25.77 %	26.35 %
South Asia	16.51 %	17.50 %
Middle East & North Africa	1.77 %	2.068 %

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 ____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
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 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	98.25
Micronesia, Fed. Sts	East Asia & Pacific	91.85
Gabon	Sub-Saharan Africa	90.03
Seychelles	Sub-Saharan Africa	88.41

Palau	East Asia & Pacific	87.60
American Samoa	East Asia & Pacific	87.50
Guyana	Latin America & Caribbean	83.90
Lao PDR	East Asia & Pacific	82.10
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 data provided has proved that forest area decreased in countries with bigger land mass. Smaller countries have more growth but the numbers could be skewed because of the difference in country size compared to a country such as China or the United states.

- *Which countries should we focus on over others? As a whole the world needs to focus on the deforestation as a whole. The countries with large land mass or massive decrease according to the above tables and data should focus on maintaining the forest and regulate on deforestation.*

APPENDIX SQL queries used

```
#Creation of forestation VIEW#

CREATE VIEW forestation AS (
      SELECT
      f_area.country_code,
      f_area.country_name,
      f_area.year,
      f_area.forest_area_sqkm,
      l_area.total_area_sq_mi,
      r.region,
      r.income_group,

      ((f_area.forest_area_sqkm) / (l_area.total_area_sq_mi * 2.95 )) *
100 AS land_area_forest_percentage

      FROM forest_area f_area, land_area l_area, regions r
      WHERE f_area.country_code = l_area.country_code
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      AND f_area.year = l_area.year
      AND l_area.country_code = r.country_code)

#1.GLOBAL SITUATION#

      SELECT *
      FROM forest_area
      WHERE country_name = 'World'
      AND (year = 1990 OR year = 2016);

      SELECT curr.forest_area_sqkm - prev.forest_area_sqkm AS difference
      FROM forest_area curr
      JOIN forest_area prev
      ON (curr.year = '2016'
      AND prev.year = '1990'
      AND curr.country_name = 'World'  AND prev.country_name = 'World');

      SELECT 100* (curr.forest_area_sqkm - prev.forest_area_sqkm) /
prev.forest_area_sqkm AS percentage
      FROM forest_area curr
      JOIN forest_area prev
      ON (curr.year = '2016'
      AND prev.year = '1990'
      AND curr.country_name = 'World'  AND prev.country_name = 'World');

#Instructor gave answer of 'PERU'#

      SELECT country_name, (total_area_sq_mi * 2.59) total_area_sq_mi
      FROM forestation
      WHERE country_name = 'Peru' AND year = 2016
      ORDER BY total_area_sq_mi  DESC;

 #2.REGINOAL OUTLOOK#

      SELECT land_area_forest_percentage
      FROM forestation
      WHERE year = 2016
      AND country_name = 'World';

      SELECT land_area_forest_percentage
      FROM forestation
      WHERE year = 1990
      AND country_name = 'World';

      SELECT region,
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```
      (SUM(forest_area_sqkm) * 100 / SUM(total_area_sq_mi * 2.59)) AS
percentage
      FROM forestation
      WHERE year = 2016
      GROUP BY 1
      ORDER BY 2 DESC;

      SELECT region,
      (SUM(forest_area_sqkm) * 100 / SUM(total_area_sq_mi * 2.59)) AS
percentage
      FROM forestation
      WHERE year = 1990
      GROUP BY 1
      ORDER BY 2 DESC;

#3. COUNTRY-LEVEL DETAIL#

#SUCCESSSTORIES#
  WITH tb1 AS(
  SELECT region, country_name, forest_area_sqkm
  FROM forestation
  WHERE year = 1990),

  tb2 AS(
  SELECT region, country_name, forest_area_sqkm
  FROM forestation
  WHERE year = 2016)

  SELECT tb1.region, tb1.country_name, tb1.forest_area_sqkm AS
forest_1990, tb2.forest_area_sqkm AS forest_2016,
ROUND(CAST((tb2.forest_area_sqkm - tb1.forest_area_sqkm) AS numeric), 2)
AS difference, ROUND(CAST(((tb2.forest_area_sqkm - tb1.forest_area_sqkm)*
100 / tb1.forest_area_sqkm) AS numeric), 2) AS increase_percent
  FROM tb1
  JOIN tb2
  ON tb1.country_name = tb2.country_name
  WHERE tb2.forest_area_sqkm > tb1.forest_area_sqkm
  ORDER BY difference DESC;

#SUCCESSSTORIESCONT#

  WITH tb1 AS(
  SELECT region, country_name, forest_area_sqkm
  FROM forestation
  WHERE year = 1990),
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```
  tb2 AS(
  SELECT region, country_name, forest_area_sqkm
  FROM forestation
  WHERE year = 2016)

  SELECT tb1.region, tb1.country_name, tb1.forest_area_sqkm AS
forest_1990,
  tb2.forest_area_sqkm AS forest_2016, ROUND(CAST((tb2.forest_area_sqkm -
tb1.forest_area_sqkm) AS numeric), 2) AS difference,
  ROUND(CAST(((tb2.forest_area_sqkm - tb1.forest_area_sqkm)* 100 /
tb1.forest_area_sqkm) AS numeric), 2) AS increase_percent
  FROM tb1
  JOIN tb2
  ON tb1.country_name = tb2.country_name
  WHERE tb2.forest_area_sqkm > tb1.forest_area_sqkm
  ORDER BY increase_percent DESC;


  #TABLE3.1#
  WITH tb1 AS(
  SELECT region, country_name, forest_area_sqkm
  FROM forestation
  WHERE year = 1990),

  tb2 AS(
  SELECT region, country_name, forest_area_sqkm
  FROM forestation
  WHERE year = 2016)

  SELECT tb1.region, tb1.country_name, tb1.forest_area_sqkm AS
forest_1990, tb2.forest_area_sqkm AS forest_2016,
ROUND(CAST((tb2.forest_area_sqkm - tb1.forest_area_sqkm) AS numeric), 2)
AS absolute_forest_area_change
  FROM tb1
  JOIN tb2
  ON tb1.country_name = tb2.country_name
  WHERE tb2.forest_area_sqkm < tb1.forest_area_sqkm
  AND tb1.region NOT LIKE 'World'
  ORDER BY absolute_forest_area_change
  LIMIT 5;

  #Table3.2#

  WITH tb1 AS(
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```
  SELECT region, country_name, forest_area_sqkm
  FROM forestation
  WHERE year = 1990),

  tb2 AS(
  SELECT region, country_name, forest_area_sqkm
  FROM forestation
  WHERE year = 2016)

  SELECT tb1.region,
  tb1.country_name,
  tb1.forest_area_sqkm AS forest_1990,
  tb2.forest_area_sqkm AS forest_2016, ROUND(CAST((tb2.forest_area_sqkm -
tb1.forest_area_sqkm) AS numeric), 2) AS absolute_forest_area_change,
  ROUND(CAST(((tb1.forest_area_sqkm - tb2.forest_area_sqkm) * 100 /
tb1.forest_area_sqkm) AS numeric), 2) AS forest_area_decrease_perc
  FROM tb1
  JOIN tb2
  ON tb1.country_name = tb2.country_name
  WHERE tb2.forest_area_sqkm < tb1.forest_area_sqkm
  ORDER BY forest_area_decrease_perc DESC
  LIMIT 5;

  #QUARTILE#
  #TABLE3.3#
  WITH tb_2016 AS
    (SELECT country_name,
                  ((SUM(forest_area_sqkm) * 100) / SUM(total_area_sq_mi *
2.59)) AS pct_forest_area, year
  FROM forestation
  WHERE year = 2016
  GROUP BY 1, 3
  ORDER BY 2)

  SELECT DISTINCT(quartiles),
    COUNT(country_name) OVER (PARTITION BY quartiles)
  FROM
    (SELECT country_name,
            CASE
                  WHEN pct_forest_area >= 0 AND pct_forest_area < 25 THEN
'0-25%'
                  WHEN pct_forest_area >= 25 AND pct_forest_area < 50 THEN
'25-50%'
                  WHEN pct_forest_area >= 50 AND pct_forest_area < 75 THEN
  '50-75%'
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                ELSE '75=100%'
            END AS quartiles
     FROM tb_2016
            WHERE year = 2016 AND pct_forest_area IS NOT NULL)
 quartile_table
 ORDER BY 2;

#TABLE3.4#

WITH tb_2016 AS
(SELECT country_name, region, ((SUM(forest_area_sqkm) * 100) /
SUM(total_area_sq_mi * 2.59)) AS pct_forest_area, year
FROM forestation

WHERE year = 2016
  GROUP BY 1, 2, 4
  ORDER BY 3)

SELECT country_name, region, pct_forest_area
FROM tb_2016
WHERE pct_forest_area >= 75
ORDER BY pct_forest_area DESC;


# Some Code was Modified from the following:#
https://github.com/mirushka/SQL-Nanodegree/blob/main/Deforestation%20Exploration%20Solution%20Chrienova.pdf
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