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 **3.21**%.

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 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 |
| Sub-Saharan Africa | 30.67 | 28.79 |
| Europe & Central Asia | 37.28 | 38.04 |
| East Asia & Pacific | 25.78 | 26.36 |
| South Asia | 16.51 | 17.51 |
| Middle East & North Africa | 1.78 | 2.07 |
| North America | 35.65 | 36.04 |

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**

### 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.

### 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 | 282193.9844 |
| Myanmar | East Asia & Pacific | 107234.0039 |
| Nigeria | Sub-Saharan Africa | 106506.00098 |
| 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.

### 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 **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 |
| American Samoa | East Asia & Pacific | 87.50 |
| Gabon | Sub-Saharan Africa | 90.04 |
| Guyana | Latin America & Caribbean | 83.90 |
| Lao PDR | East Asia & Pacific | 82.11 |
| Micronesia, Fed. Sts. | East Asia & Pacific | 91.86 |
| Palau | East Asia & Pacific | 87.61 |
| Seychelles | Sub-Saharan Africa | 88.41 |

## 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?*

As an analyst on the Forest Query team, I observed from my analysis that regions in the Sub-Saharan Africa have lost significant forest area percentage . Nigeria with an enormous amount of land per square kilometer has a 61.80 percentage decrease which is a huge concern on climate change and sustainability of the earth.

Countries in the Sub-Saharan Africa, East Asia & Pacific and Latin America & Caribbean emulate countries like the United States, China and Iceland by trying to increase their forest area and reduce deforestation. The world needs a susatainable environment and a well functioning ecosystem and forestation is a crucial way to achieve that.

## **APPENDIX: SQL QUERIES**

## 1. GLOBAL SITUATION

DROP VIEW IF EXISTS forestation;  
  
CREATE VIEW forestation  
AS  
  SELECT fa.country\_code,  
         fa.country\_name,  
         fa.year,  
         fa.forest\_area\_sqkm,  
         la.total\_area\_sq\_mi,  
         la.total\_area\_sq\_mi \* 2.59                               AS  
            total\_area\_sqkm,  
         r.region,  
         r.income\_group,  
         ( forest\_area\_sqkm \* 100 ) / ( total\_area\_sq\_mi \* 2.59 ) AS  
            percent\_forest  
  FROM   forest\_area fa  
         JOIN land\_area la  
           ON fa.country\_code = la.country\_code  
              AND fa.year = la.year  
         JOIN regions r  
           ON r.country\_code = la.country\_code;

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) AS forest\_area\_1990  
FROM   forestation  
WHERE  year = 1990  
       AND country\_name = '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) AS forest\_area\_2016  
FROM   forestation  
WHERE  year = 2016  
       AND country\_name = 'World';

c. What was the change (in sq km) in the forest area of the world from 1990 to 2016?

SELECT (SELECT *Sum*(forest\_area\_sqkm) AS forest\_area\_1990  
        FROM   forestation  
        WHERE  year = 1990  
               AND country\_name = 'World') - (SELECT  
              *Sum*(forest\_area\_sqkm) AS forest\_area\_2016  
                                              FROM   forestation  
                                              WHERE  year = 2016  
                                                     AND country\_name = 'World')  
       AS  
       forest\_change;

d. What was the percent change in forest area of the world between 1990 and 2016?

WITH world\_1990  
     AS (SELECT country\_name,  
                forest\_area\_sqkm  
         FROM   forestation  
         WHERE  year = 1990  
                AND region = 'World'),  
     world\_2016  
     AS (SELECT country\_name,  
                forest\_area\_sqkm  
         FROM   forestation  
         WHERE  year = 2016  
                AND region = 'World'),  
     tab1  
     AS (SELECT world\_1990.country\_name,  
                world\_1990.forest\_area\_sqkm     AS forest\_1990,  
                world\_2016.forest\_area\_sqkm     AS forest\_2016,  
                ( ( world\_2016.forest\_area\_sqkm -  
                  world\_1990.forest\_area\_sqkm ) \* 100 /  
                  world\_1990.forest\_area\_sqkm ) AS percent\_change  
         FROM   world\_1990  
                join world\_2016  
                  ON world\_1990.country\_name = world\_2016.country\_name)  
SELECT country\_name,  
       forest\_1990,  
       forest\_2016,  
       **Round**(percent\_change :: NUMERIC, 2)  
FROM   tab1;

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,  
       **Abs**(( total\_area\_sqkm ) - (SELECT (SELECT **Sum**(forest\_area\_sqkm) AS  
                                                 forest\_area\_1990  
                                          FROM   forestation  
                                          WHERE  year = 1990  
                                                 AND country\_name = 'World') -  
                                             (SELECT **Sum**(forest\_area\_sqkm) AS  
                                                     forest\_area\_2016  
                                              FROM   forestation  
                                              WHERE  year = 2016  
                                                     AND country\_name = 'World'  
                                             ) AS  
                                         forest\_change)) AS forest\_area\_diff  
FROM   forestation  
WHERE  year = 2016  
ORDER  BY 3  
LIMIT  1;

## 2. REGIONAL OUTLOOK

DROP VIEW IF EXISTS regions\_percent\_area;  
  
CREATE VIEW regions\_percent\_area  
AS  
  SELECT r.region,  
         la.year,  
         **Sum**(fa.forest\_area\_sqkm)                                             AS  
            sum\_forest\_area\_sqkm,  
         **Sum**(la.total\_area\_sq\_mi \* 2.59)                                      AS  
            sum\_total\_area\_sqkm,  
         ( **Sum**(fa.forest\_area\_sqkm) / **Sum**(la.total\_area\_sq\_mi \* 2.59) ) \* 100 AS  
         percent\_forest\_region  
  FROM   forest\_area fa  
         JOIN land\_area la  
           ON fa.country\_code = la.country\_code  
              AND fa.year = la.year  
         JOIN regions r  
           ON la.country\_code = la.country\_code  
  GROUP  BY 1,  
            2  
  ORDER  BY 1,  
            2;

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?

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?

c. Based on the table you created, which regions of the world DECREASED in forest area from 1990 to 2016?

WITH forest\_percentage\_1990  
     AS (SELECT region,  
                ( **SUM**(forest\_area\_sqkm) \* 100 / **SUM**(total\_area\_sqkm) )  
                   percentage\_forest\_1990  
         FROM   forestation  
         WHERE  year = 1990  
         GROUP  BY 1),  
     forest\_percentage\_2016  
     AS (SELECT region,  
                ( **SUM**(forest\_area\_sqkm) \* 100 / **SUM**(total\_area\_sqkm) )  
                   percentage\_forest\_2016  
         FROM   forestation  
         WHERE  year = 2016  
         GROUP  BY 1),  
     joinded\_1990\_2016  
     AS (SELECT \*  
         FROM   forest\_percentage\_1990  
                join forest\_percentage\_2016 USING(region))  
SELECT \*,  
       **Round**(( percentage\_forest\_1990 - percentage\_forest\_2016 ) :: NUMERIC, 2)  
       AS diff  
FROM   joinded\_1990\_2016;

## 3. COUNTRY-LEVEL DETAIL

a. Which 5 countries saw the largest amount decrease in forest area from 1990 to 2016? What was the difference in forest area for each?

WITH table\_1990 AS  
(  
       SELECT country\_code,  
              country\_name,  
              year,  
              forest\_area\_sqkm  
       FROM   forest\_area  
       WHERE  year = 1990  
       AND    forest\_area\_sqkm IS NOT NULL  
       AND    country\_name != 'World' ), table\_2016 AS  
(  
       SELECT country\_code,  
              country\_name,  
              year,  
              forest\_area\_sqkm  
       FROM   forest\_area  
       WHERE  year = 2016  
       AND    forest\_area\_sqkm IS NOT NULL  
       AND    country\_name != 'World' )  
SELECT   table\_1990.country\_code,  
         table\_1990.country\_name,  
         r.region,  
         table\_1990.forest\_area\_sqkm                               AS forest\_area\_1990,  
         table\_2016.forest\_area\_sqkm                               AS forest\_area\_2016,  
         table\_1990.forest\_area\_sqkm - table\_2016.forest\_area\_sqkm AS forest\_change\_sqkm  
FROM     table\_1990  
JOIN     table\_2016  
ON       table\_1990.country\_code = table\_2016.country\_code  
AND      (  
                  table\_1990.forest\_area\_sqkm IS NOT NULL  
         AND      table\_2016.forest\_area\_sqkm IS NOT NULL)  
JOIN     regions r  
ON       table\_2016.country\_code = r.country\_code  
ORDER BY 6 DESC limit 5;

b. Which 5 countries saw the largest percent decrease in forest area from 1990 to 2016? What was the percent change to 2 decimal places for each?

WITH table\_1990 AS  
(  
       SELECT country\_code,  
              country\_name,  
              year,  
              forest\_area\_sqkm  
       FROM   forest\_area  
       WHERE  year = 1990  
       AND    forest\_area\_sqkm IS NOT NULL  
       AND    country\_name != 'World' ), table\_2016 AS  
(  
       SELECT country\_code,  
              country\_name,  
              year,  
              forest\_area\_sqkm  
       FROM   forest\_area  
       WHERE  year = 2016  
       AND    forest\_area\_sqkm IS NOT NULL  
       AND    country\_name != 'World' )  
SELECT   table\_1990.country\_code,  
         table\_1990.country\_name,  
         r.region,  
         table\_1990.forest\_area\_sqkm                                                                                          AS forest\_area\_1990,  
         table\_2016.forest\_area\_sqkm                                                                                          AS forest\_area\_2016,  
         table\_1990.forest\_area\_sqkm - table\_2016.forest\_area\_sqkm                                                            AS forest\_change\_sqkm,  
         *Abs*(*Round*(((table\_2016.forest\_area\_sqkm - table\_1990.forest\_area\_sqkm)/table\_1990.forest\_area\_sqkm\*100)::numeric,2)) AS percent\_forest\_change  
FROM     table\_1990  
JOIN     table\_2016  
ON       table\_1990.country\_code = table\_2016.country\_code  
AND      (  
                  table\_1990.forest\_area\_sqkm IS NOT NULL  
         AND      table\_2016.forest\_area\_sqkm IS NOT NULL)  
JOIN     regions r  
ON       table\_2016.country\_code = r.country\_code  
ORDER BY *Round*(((table\_2016.forest\_area\_sqkm-table\_1990.forest\_area\_sqkm)/table\_1990.forest\_area\_sqkm\*100)::numeric,2) limit 5;

c. If countries were grouped by percent forestation in quartiles, which group had the most countries in it in 2016?

WITH tab1  
     AS (SELECT f.country\_code,  
                f.country\_name,  
                f.year,  
                f.forest\_area\_sqkm,  
                l.total\_area\_sq\_mi \* 2.59                                    AS  
                   total\_area\_sqkm,  
                ( f.forest\_area\_sqkm / ( l.total\_area\_sq\_mi \* 2.59 ) ) \* 100 AS  
                percent\_forest\_area  
         FROM   forest\_area f  
                JOIN land\_area l  
                  ON f.country\_code = l.country\_code  
                     AND ( f.country\_name != 'World'  
                           AND f.forest\_area\_sqkm IS NOT NULL  
                           AND l.total\_area\_sq\_mi IS NOT NULL )  
                     AND ( f.year = 2016  
                           AND l.year = 2016 )  
         ORDER  BY 6 DESC),  
     tab2  
     AS (SELECT tab1.country\_code,  
                tab1.country\_name,  
                tab1.year,  
                tab1.percent\_forest\_area,  
                CASE  
                  WHEN tab1.percent\_forest\_area >= 75 THEN 4  
                  WHEN tab1.percent\_forest\_area < 75  
                       AND tab1.percent\_forest\_area >= 50 THEN 3  
                  WHEN tab1.percent\_forest\_area < 50  
                       AND tab1.percent\_forest\_area >= 25 THEN 2  
                  ELSE 1  
                END AS percentile  
         FROM   tab1  
         ORDER  BY 5 DESC)  
SELECT tab2.percentile,  
       *Count*(tab2.percentile)  
FROM   tab2  
GROUP  BY 1  
ORDER  BY 2 DESC;

d. List all of the countries that were in the 4th quartile (percent forest > 75%) in 2016.

WITH tab1  
     AS (SELECT f.country\_code,  
                f.country\_name,  
                f.year,  
                f.forest\_area\_sqkm,  
                l.total\_area\_sq\_mi \* 2.59                                    AS  
                   total\_area\_sqkm,  
                ( f.forest\_area\_sqkm / ( l.total\_area\_sq\_mi \* 2.59 ) ) \* 100 AS  
                percent\_forest\_area  
         FROM   forest\_area f  
                JOIN land\_area l  
                  ON f.country\_code = l.country\_code  
                     AND ( f.country\_name != 'World'  
                           AND f.forest\_area\_sqkm IS NOT NULL  
                           AND l.total\_area\_sq\_mi IS NOT NULL )  
                     AND ( f.year = 2016  
                           AND l.year = 2016 )  
         ORDER  BY 6 DESC),  
     tab2  
     AS (SELECT tab1.country\_code,  
                tab1.country\_name,  
                tab1.year,  
                tab1.percent\_forest\_area,  
                CASE  
                  WHEN tab1.percent\_forest\_area >= 75 THEN 4  
                  WHEN tab1.percent\_forest\_area < 75  
                       AND tab1.percent\_forest\_area >= 50 THEN 3  
                  WHEN tab1.percent\_forest\_area < 50  
                       AND tab1.percent\_forest\_area >= 25 THEN 2  
                  ELSE 1  
                END AS percentile  
         FROM   tab1  
         ORDER  BY 5 DESC)  
SELECT tab2.country\_name,  
       r.region,  
       *Round*(*Cast*(tab2.percent\_forest\_area AS *NUMERIC*), 2) AS  
       percent\_forest\_area,  
       tab2.percentile  
FROM   tab2  
       JOIN regions r  
         ON tab2.country\_code = r.country\_code  
WHERE  tab2.percentile = 4  
ORDER  BY 1;

e. How many countries had a percent forestation higher than the United States in 2016?

WITH tab1  
     AS (SELECT f.country\_code,  
                f.country\_name,  
                f.year,  
                f.forest\_area\_sqkm,  
                l.total\_area\_sq\_mi \* 2.59                                    AS  
                   total\_area\_sqkm,  
                ( f.forest\_area\_sqkm / ( l.total\_area\_sq\_mi \* 2.59 ) ) \* 100 AS  
                percent\_forest\_area  
         FROM   forest\_area f  
                JOIN land\_area l  
                  ON f.country\_code = l.country\_code  
                     AND ( f.country\_name != 'World'  
                           AND f.forest\_area\_sqkm IS NOT NULL  
                           AND l.total\_area\_sq\_mi IS NOT NULL )  
                     AND ( f.year = 2016  
                           AND l.year = 2016 )  
         ORDER  BY 6 DESC)  
SELECT *Count*(tab1.country\_name)  
FROM   tab1  
WHERE  tab1.percent\_forest\_area > (SELECT tab1.percent\_forest\_area  
                                   FROM   tab1  
                                   WHERE  tab1.country\_name = 'United States')