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 41282694.90 km2 in 1990. As of 2016, the most recent year for which data was available, that number had fallen to39958245.90 km2, a loss of 1324449 km2, 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 km2).

## 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 |
| World | 32.42 | 31.38 |
| 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 km2. 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 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.

### 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 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 Tongo, 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 |
| First | 85 |
| Second | 73 |
| Third | 38 |
| Fourth | 9 |

The largest number of countries in 2016 were found in the first or (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 | 98.26 |
| 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 Samao | 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?*
* *World lost 3.21% of its total forest land, which is slightly more than the entire land area of a country, Peru, which is concerning.*
* *Latin America & Caribbean and Sub-Saharan Africa were the two regions which had lost its forest land unlike some other regions.*
* *Countries like China and United States and also a small country like Iceland has increased its forest area significantly compared to others from 1990 to 2016.*
* *Which countries should we focus on over others? We should focus on countries with large area or major decrease in forest area.*
* *We should focus on countries in table 3.1, 3.2, and 3.4 over others in reversing the deforestation which would help in decreasing the overall deforestation of the world.*

APPENDIX: SQL queries used

1) Creating view –

DROP VIEW IF EXISTS forstation;  
  
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,  
          r.region,  
          r.income\_group,  
          **Round**(( ( f.forest\_area\_sqkm / ( l.total\_area\_sq\_mi \* 2.59 ) ) \* 100 )  
                ::  
                numeric, 2)         perc\_forest\_larea\_sqkm  
   FROM   forest\_area f  
          JOIN land\_area l  
            ON f.country\_code = l.country\_code  
               AND f.year = l.year  
          JOIN regions r  
            ON f.country\_code = r.country\_code)

2) Global Situation

a. What was the total forest area (in sq km) of the world in 1990?

SELECT **Round**(forest\_area\_sqkm :: NUMERIC, 2)  
FROM   forestation  
WHERE  country\_name = 'World'  
       AND year = '1990'

b. What was the total forest area (in sq km) of the world in 2016?

SELECT **Round**(forest\_area\_sqkm :: NUMERIC, 2)  
FROM   forestation  
WHERE  country\_name = 'World'  
       AND year = '2016'

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

WITH t1  
     AS (SELECT country\_name,  
                **Round**(forest\_area\_sqkm :: NUMERIC, 2) AS fa\_1990  
         FROM   forestation  
         WHERE  country\_name = 'World'  
                AND year = '1990'),  
     t2  
     AS (SELECT country\_name,  
                **Round**(forest\_area\_sqkm :: NUMERIC, 2) AS fa\_2016  
         FROM   forestation  
         WHERE  country\_name = 'World'  
                AND year = '2016')  
SELECT t1.country\_name,  
       t1.fa\_1990,  
       t2.fa\_2016,  
       **Abs**(t2.fa\_2016 - t1.fa\_1990) change\_fa  
FROM   t1  
       join t2  
         ON t1.country\_name = t2.country\_name

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

WITH t1  
     AS (SELECT country\_name,  
                **Round**(forest\_area\_sqkm :: NUMERIC, 2) AS fa\_1990  
         FROM   forestation  
         WHERE  country\_name = 'World'  
                AND year = '1990'),  
     t2  
     AS (SELECT country\_name,  
                **Round**(forest\_area\_sqkm :: NUMERIC, 2) AS fa\_2016  
         FROM   forestation  
         WHERE  country\_name = 'World'  
                AND year = '2016')  
SELECT t1.country\_name,  
       t1.fa\_1990,  
       t2.fa\_2016,  
       **Round**(( **Abs**(t2.fa\_2016 - t1.fa\_1990) / t1.fa\_1990 ) \* 100 :: NUMERIC, 2)  
       perc\_change\_fa  
FROM   t1  
       join t2  
         ON t1.country\_name = t2.country\_name

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?

WITH t1  
     AS (SELECT country\_name,  
                **Round**(forest\_area\_sqkm :: NUMERIC, 2) AS fa\_1990  
         FROM   forestation  
         WHERE  year = 1990),  
     t2  
     AS (SELECT country\_name,  
                **Round**(forest\_area\_sqkm :: NUMERIC, 2) AS fa\_2016  
         FROM   forestation  
         WHERE  year = 2016),  
     t3  
     AS (SELECT country\_name,  
                **Round**(total\_area\_sqkm :: NUMERIC, 2) AS ta\_2016  
         FROM   forestation  
         WHERE  year = 2016)  
SELECT t1.country\_name,  
       t1.fa\_1990,  
       t2.fa\_2016,  
       t2.fa\_2016 - t1.fa\_1990      change\_fa,  
       **Abs**(t2.fa\_2016 - t1.fa\_1990) abs\_change\_fa,  
       t3.ta\_2016  
FROM   t1  
       join t2  
         ON t1.country\_name = t2.country\_name  
       join t3  
         ON t1.country\_name = t3.country\_name  
ORDER  BY 6 DESC

3) Regional Outlook

a. What was the percent forest of the entire world in 2016?

SELECT **Round**(( ( forest\_area\_sqkm / total\_area\_sqkm ) \* 100 ) :: NUMERIC, 2) AS  
       perc\_for  
FROM   forestation  
WHERE  country\_name = 'World'  
       AND year = 2016

Which region had the HIGHEST percent forest in 2016, and which had the LOWEST, to 2 decimal places?

SELECT region,  
       **Round**(( ( **Sum**(forest\_area\_sqkm) / **Sum**(total\_area\_sqkm) ) \* 100 ) ::  
             NUMERIC, 2)  
       AS perc\_for\_h  
FROM   forestation  
WHERE  year = 2016  
GROUP  BY 1  
ORDER  BY 2 DESC  
LIMIT  1

SELECT region,  
       **Round**(( ( **Sum**(forest\_area\_sqkm) / **Sum**(total\_area\_sqkm) ) \* 100 ) ::  
             NUMERIC, 2)  
       AS perc\_for\_l  
FROM   forestation  
WHERE  year = 2016  
GROUP  BY 1  
ORDER  BY 2  
LIMIT  1

b. What was the percent forest of the entire world in 1990?

SELECT **Round**(( ( forest\_area\_sqkm / total\_area\_sqkm ) \* 100 ) :: NUMERIC, 2) AS  
       perc\_for  
FROM   forestation  
WHERE  country\_name = 'World'  
       AND year = 1990

Which region had the HIGHEST percent forest in 1990, and which had the LOWEST, to 2 decimal places?

SELECT region,  
       **Round**(( ( **Sum**(forest\_area\_sqkm) / **Sum**(total\_area\_sqkm) ) \* 100 ) ::  
             NUMERIC, 2)  
       AS perc\_for\_h  
FROM   forestation  
WHERE  year = 1990  
GROUP  BY 1  
ORDER  BY 2 DESC  
LIMIT  1

SELECT region,  
       **Round**(( ( **Sum**(forest\_area\_sqkm) / **Sum**(total\_area\_sqkm) ) \* 100 ) ::  
             NUMERIC, 2)  
       AS perc\_for\_l  
FROM   forestation  
WHERE  year = 1990  
GROUP  BY 1  
ORDER  BY 2  
LIMIT  1

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

WITH t1  
     AS (SELECT region,  
                **Round**(( ( **SUM**(forest\_area\_sqkm) / **SUM**(total\_area\_sqkm) ) \* 100 )  
                      ::  
                      NUMERIC, 2)  
                AS perc\_for\_1990  
         FROM   forestation  
         WHERE  year = 1990  
         GROUP  BY 1),  
     t2  
     AS (SELECT region,  
                **Round**(( ( **SUM**(forest\_area\_sqkm) / **SUM**(total\_area\_sqkm) ) \* 100 )  
                      ::  
                      NUMERIC, 2)  
                AS perc\_for\_2016  
         FROM   forestation  
         WHERE  year = 2016  
         GROUP  BY 1)  
SELECT t1.region,  
       t1.perc\_for\_1990,  
       t2.perc\_for\_2016  
FROM   t1  
       join t2  
         ON t1.region = t2.region

3) Country-Level Detail

Success Stories 1

WITH t1  
     AS (SELECT country\_name,  
                **Round**(forest\_area\_sqkm :: NUMERIC, 2) AS fa\_1990  
         FROM   forestation  
         WHERE  year = 1990),  
     t2  
     AS (SELECT country\_name,  
                **Round**(forest\_area\_sqkm :: NUMERIC, 2) AS fa\_2016  
         FROM   forestation  
         WHERE  year = 2016)  
SELECT t1.country\_name,  
       t1.fa\_1990,  
       t2.fa\_2016,  
       t2.fa\_2016 - t1.fa\_1990 change\_fa  
FROM   t1  
       join t2  
         ON t1.country\_name = t2.country\_name  
WHERE  t2.fa\_2016 > t1.fa\_1990  
       AND t1.country\_name != 'World'  
ORDER  BY 4 DESC

Success Stories 1

WITH t1 AS  
(  
       SELECT country\_name,  
              *Round*(forest\_area\_sqkm :: numeric, 2) AS fa\_1990  
       FROM   forestation  
       WHERE  year = 1990), t2 AS  
(  
       SELECT country\_name,  
              *Round*(forest\_area\_sqkm :: numeric, 2) AS fa\_2016  
       FROM   forestation  
       WHERE  year = 2016)  
SELECT   t1.country\_name,  
         t1.fa\_1990,  
         t2.fa\_2016,  
         t2.fa\_2016 - t1.fa\_1990                                        change\_fa,  
         *Round*((((t2.fa\_2016 - t1.fa\_1990)/t1.fa\_1990)\*100)::numeric,2) perc\_change\_fa  
FROM     t1  
JOIN     t2  
ON       t1.country\_name = t2.country\_name  
WHERE    t2.fa\_2016 > t1.fa\_1990  
AND      t1.country\_name != 'World'  
ORDER BY 5 DESC limit 1

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 t1 AS  
(  
       SELECT country\_name,  
              region,  
              *Round*(forest\_area\_sqkm :: numeric, 2) AS fa\_1990  
       FROM   forestation  
       WHERE  year = 1990), t2 AS  
(  
       SELECT country\_name,  
              region,  
              *Round*(forest\_area\_sqkm :: numeric, 2) AS fa\_2016  
       FROM   forestation  
       WHERE  year = 2016)  
SELECT   t1.country\_name,  
         t1.region,  
         t1.fa\_1990,  
         t2.fa\_2016,  
         t2.fa\_2016 - t1.fa\_1990      change\_fa,  
         *Abs*(t2.fa\_2016 - t1.fa\_1990) abs\_change\_fa  
FROM     t1  
JOIN     t2  
ON       t1.country\_name = t2.country\_name  
WHERE    t2.fa\_2016 < t1.fa\_1990  
AND      t1.country\_name != 'World'  
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 t1 AS  
(  
       SELECT country\_name,  
              region,  
              *Round*(forest\_area\_sqkm :: numeric, 2) AS fa\_1990  
       FROM   forestation  
       WHERE  year = 1990), t2 AS  
(  
       SELECT country\_name,  
              region,  
              *Round*(forest\_area\_sqkm :: numeric, 2) AS fa\_2016  
       FROM   forestation  
       WHERE  year = 2016)  
SELECT   t1.country\_name,  
         t1.region,  
         t1.fa\_1990,  
         t2.fa\_2016,  
         t2.fa\_2016 - t1.fa\_1990                                              change\_fa,  
         *Round*(((*Abs*(t2.fa\_2016 - t1.fa\_1990)/t1.fa\_1990)\*100) :: numeric, 2) perc\_change\_fa  
FROM     t1  
JOIN     t2  
ON       t1.country\_name = t2.country\_name  
WHERE    t2.fa\_2016 < t1.fa\_1990  
AND      t1.country\_name != 'World'  
ORDER BY 6 DESC limit 5

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

WITH t1  
     AS (SELECT country\_name,  
                CASE  
                  WHEN perc\_forest <= 25 THEN 'first'  
                  WHEN perc\_forest > 25  
                       AND perc\_forest <= 50 THEN 'second'  
                  WHEN perc\_forest > 50  
                       AND perc\_forest <= 75 THEN 'third'  
                  WHEN perc\_forest > 75 THEN 'fourth'  
                END AS quartiles  
         FROM   (SELECT country\_name,  
                        forest\_area\_sqkm,  
                        total\_area\_sqkm,  
                        ( forest\_area\_sqkm / total\_area\_sqkm ) \* 100 AS  
                        perc\_forest  
                 FROM   forestation  
                 WHERE  year = 2016  
                        AND total\_area\_sqkm IS NOT NULL  
                        AND forest\_area\_sqkm IS NOT NULL) AS pf\_2016)  
SELECT quartiles,  
       *Count*(country\_name)  
FROM   t1  
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 t1  
     AS (SELECT country\_name,  
                region,  
                perc\_forest,  
                CASE  
                  WHEN perc\_forest <= 25 THEN 'first'  
                  WHEN perc\_forest > 25  
                       AND perc\_forest <= 50 THEN 'second'  
                  WHEN perc\_forest > 50  
                       AND perc\_forest <= 75 THEN 'third'  
                  WHEN perc\_forest > 75 THEN 'fourth'  
                END AS quartiles  
         FROM   (SELECT country\_name,  
                        region,  
                        forest\_area\_sqkm,  
                        total\_area\_sqkm,  
                        ( forest\_area\_sqkm / total\_area\_sqkm ) \* 100 AS  
                        perc\_forest  
                 FROM   forestation  
                 WHERE  year = 2016  
                        AND total\_area\_sqkm IS NOT NULL  
                        AND forest\_area\_sqkm IS NOT NULL) AS pf\_2016)  
SELECT country\_name,  
       region,  
       **Round**(perc\_forest :: NUMERIC, 2) AS pct\_forest  
FROM   t1  
WHERE  quartiles = 'fourth'  
ORDER  BY 3 DESC

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

SELECT **Count**(country\_name)  
FROM   forestation  
WHERE  **Round**(( ( forest\_area\_sqkm / total\_area\_sqkm ) \* 100 ) :: NUMERIC, 2) > (  
       SELECT  
              **Round**(( ( forest\_area\_sqkm / total\_area\_sqkm ) \* 100 ) :: NUMERIC,  
              2) AS  
              percent\_forest  
       FROM  
              forestation  
       WHERE  
              year = 2016  
              AND country\_name = 'United States')  
       AND year = 2016