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 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 sqkm in 1990. As of 2016, the most recent year for which data was available, that number had fallen to39958245.90 sqkm, a loss of 1324449.00 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 31.38%. The region with the highest relative forestation was Latin America & Caribbean, with 98.26%, 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 |
| East Asia & Pacific | 25.78% | 26.36% |
| Europe & Central Asia | 37.28% | 38.04% |
| Latin America & Caribbean | 51.03% | 46.16% |
| Middle East & North Africa | 1.78% | 2.07% |
| North America | 35.65% | 36.04% |
| South Asia | 16.51% | 17.51% |
| Sub-Saharan Africa | 30.67% | 28.79% |
| World | 32.42% | 31.38% |

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 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 increased in forest area from 1990 to 2016 by 527229.06 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 79200.00 sqkm, much lower than the figure for China.

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 212.50% 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: Brazil, Indonesia, and Myanmar.

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 sqkm |
| Indonesia | East Asia & Pacific | 282193.98 sqkm |
| Myanmar | East Asia & Pacific | 107234.00 sqkm |
| Nigeria | Sub-Saharan Africa | 106506.00 sqkm |
| Tanzania | Sub-Saharan Africa | 102320.00 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 | 75.46% |
| Nigeria | Sub-Saharan Africa | 61.79% |
| Uganda | Sub-Saharan Africa | 59.59% |
| 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 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 |
| 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 | 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?*
* *Which countries should we focus on over others?*

Nigeria is a strong candidate country that deserves ForestQuery’s attention. It was the only country to make the top five in both forest percentage loss and forest area loss. Here are my following recommendations of actions to take in Nigeria to help combat the deforestation rate:

Reforestation is a measure that could be taken as the National Environmental Standards and Regulations Agency (NESREA) in Nigeria has already been empowered by law to tackle this method of planting trees to replace ones lost. In 2005 alone, approximately 1 million hectares of land have been reforested.

Lobbying for the protection of the existing forest. Enforcing logging regulations and implementing a mandatory “plant a tree” program for all logging companies could assist in the efforts of reforestation. We can also help to lobby for forest guards to be equipped with the necessary tools and equipment to help ensure effective and efficient job completions.

Lastly, we can help educate citizens on the small things they can do to help impact the reforestation effort. Going paperless, eating less meat, and focusing efforts on finding alternative forms of cooking fuel, like kerosene, could help reduce the need for logging and forest clearing.

# Appendix

#### Creating the View

DROP VIEW IF EXISTS forestation; CREATE VIEW forestation AS  
            (  
                   SELECT f.country\_code,  
                          f.country\_name,  
                          f.year,  
                          *Round*(f.forest\_area\_sqkm::numeric, 2) AS forest\_area\_sqkm,  
                          *Round*((l.total\_area\_sq\_mi \* 2.59)::numeric,2)  AS total\_land\_area\_sqkm,  
                          *Round*((f.forest\_area\_sqkm / (l.total\_area\_sq\_mi \* 2.59) \* 100)::numeric,2)  AS percentage\_of\_forest,  
                          r.region,  
                          r.income\_group  
                   FROM   forest\_area AS f  
                   JOIN   land\_area   AS l  
                   ON     f.year = l.year  
                   AND    f.country\_code = l.country\_code  
                   JOIN   regions AS r  
                   ON     r.country\_code = l.country\_code  
            );SELECT \*  
FROM   forestation

LIMIT 300;

#### Global Situation Q 1A

SELECT year,  
       *Sum*(forest\_area\_sqkm) AS total\_forest\_area\_sqkm  
FROM   forestation  
WHERE  region = 'World'  
       AND year = 1990  
GROUP  BY 1;

#### Global Situation Q 1B

#### SELECT year,        *Sum*(forest\_area\_sqkm) AS total\_forest\_area\_sqkm FROM   forestation WHERE  region = 'World'        AND year = 2016 GROUP  BY 1;

#### Global Situation Q 1C

WITH forest\_area\_2016  
     AS (SELECT year,  
                *Sum*(forest\_area\_sqkm) AS total\_forest\_area\_2016  
         FROM   forestation  
         WHERE  region = 'World'  
                AND year = 2016  
         GROUP  BY 1),  
     forest\_area\_1990  
     AS (SELECT year,  
                *Sum*(forest\_area\_sqkm) AS total\_forest\_area\_1990  
         FROM   forestation  
         WHERE  region = 'World'  
                AND year = 1990  
         GROUP  BY 1)  
SELECT total\_forest\_area\_1990 - total\_forest\_area\_2016 AS difference  
FROM   forest\_area\_2016,  
       forest\_area\_1990

#### Global Situation Q 1D

WITH forest\_area\_2016  
     AS (SELECT year,  
                *Sum*(forest\_area\_sqkm) AS total\_forest\_area\_2016  
         FROM   forestation  
         WHERE  region = 'World'  
                AND year = 2016  
         GROUP  BY 1),  
     forest\_area\_1990  
     AS (SELECT year,  
                *Sum*(forest\_area\_sqkm) AS total\_forest\_area\_1990  
         FROM   forestation  
         WHERE  region = 'World'  
                AND year = 1990  
         GROUP  BY 1)  
SELECT ( total\_forest\_area\_1990 - total\_forest\_area\_2016 ) \* 100 /  
       total\_forest\_area\_1990 AS diff\_percentage  
FROM   forest\_area\_2016,  
       forest\_area\_1990

#### Global Situation Q 1E

WITH forest\_area\_2016 AS  
(  
         SELECT   year,  
                  *Sum*(forest\_area\_sqkm) AS total\_forest\_area\_2016  
         FROM     forestation  
         WHERE    region = 'World'  
         AND      year = 2016  
         GROUP BY 1),

forest\_area\_1990 AS  
(  
         SELECT   year,  
                  *Sum*(forest\_area\_sqkm) AS total\_forest\_area\_1990  
         FROM     forestation  
         WHERE    region = 'World'  
         AND      year = 1990  
         GROUP BY 1),

difference\_forest\_area AS  
(  
       SELECT (total\_forest\_area\_1990 - total\_forest\_area\_2016) AS difference  
       FROM   forest\_area\_2016,  
              forest\_area\_1990)  
SELECT   country\_name,  
         total\_land\_area\_sqkm  
FROM     forestation  
WHERE    year = 2016  
AND      total\_land\_area\_sqkm < 1324449  
ORDER BY 2 DESC limit 2;

#### Regional Outlook Q 1A

WITH percentage\_forest\_2016  
     AS (SELECT region,  
                **Round**(( **SUM**(forest\_area\_sqkm) / **SUM**(total\_land\_area\_sqkm) \* 100  
                      ) ::  
                      NUMERIC, 2)  
                AS percentage\_2016  
         FROM   forestation  
         WHERE  year = 2016  
         GROUP  BY 1),  
     percentage\_forest\_1990  
     AS (SELECT region,  
                **Round**(( **SUM**(forest\_area\_sqkm) / **SUM**(total\_land\_area\_sqkm) \* 100  
                      ) ::  
                      NUMERIC, 2)  
                AS percentage\_1990  
         FROM   forestation  
         WHERE  year = 1990  
         GROUP  BY 1),  
     joined\_2016\_1990  
     AS (SELECT percentage\_forest\_2016.region,  
                percentage\_1990,  
                percentage\_2016  
         FROM   percentage\_forest\_2016  
                join percentage\_forest\_1990  
                  ON percentage\_forest\_2016.region =  
                     percentage\_forest\_1990.region)  
SELECT region,  
       **Min**(percentage\_2016)  
FROM   joined\_2016\_1990  
GROUP  BY 1  
ORDER  BY 2 ASC

/////

SELECT region,  
       **Max**(percentage\_2016)  
FROM   joined\_2016\_1990  
GROUP  BY 1  
ORDER  BY 2 DESC

/////

SELECT region,  
       **Sum**(percentage\_2016)  
FROM   joined\_2016\_1990

WHERE region = ‘World’  
GROUP  BY 1  
ORDER  BY 2 SUM

#### Regional Outlook Q 1B

WITH percentage\_forest\_2016  
     AS (SELECT region,  
                **Round**(( **SUM**(forest\_area\_sqkm) / **SUM**(total\_land\_area\_sqkm) \* 100  
                      ) ::  
                      NUMERIC, 2)  
                AS percentage\_2016  
         FROM   forestation  
         WHERE  year = 2016  
         GROUP  BY 1),  
     percentage\_forest\_1990  
     AS (SELECT region,  
                **Round**(( **SUM**(forest\_area\_sqkm) / **SUM**(total\_land\_area\_sqkm) \* 100  
                      ) ::  
                      NUMERIC, 2)  
                AS percentage\_1990  
         FROM   forestation  
         WHERE  year = 1990  
         GROUP  BY 1),  
     joined\_2016\_1990  
     AS (SELECT percentage\_forest\_2016.region,  
                percentage\_1990,  
                percentage\_2016  
         FROM   percentage\_forest\_2016  
                join percentage\_forest\_1990  
                  ON percentage\_forest\_2016.region =  
                     percentage\_forest\_1990.region)  
SELECT region,  
       **Min**(percentage\_1990)  
FROM   joined\_2016\_1990  
GROUP  BY 1  
ORDER  BY 2 ASC

/////

SELECT region,  
       **Max**(percentage\_1990)  
FROM   joined\_2016\_1990  
GROUP  BY 1  
ORDER  BY 2 DESC

/////

SELECT region,  
       **Sum**(percentage\_1990)  
FROM   joined\_2016\_1990  
GROUP  BY 1  
ORDER  BY 2 SUM

#### Regional Outlook Q 1C

WITH world\_forest\_2016 AS  
(  
         SELECT   region,  
                  *Sum*(percentage\_of\_forest) AS sum\_forest\_2016  
         FROM     forestation  
         WHERE    year = 2016  
         GROUP BY 1  
         ORDER BY 2 DESC ), world\_forest\_1990 AS  
(  
         SELECT   region,  
                  *Sum*(percentage\_of\_forest) AS sum\_forest\_1990  
         FROM     forestation  
         WHERE    year = 1990  
         GROUP BY 1  
         ORDER BY 2 DESC )  
SELECT   forestation.region,  
         sum\_forest\_2016,  
         sum\_forest\_1990,  
         (sum\_forest\_1990 - sum\_forest\_2016) AS forest\_difference  
FROM     world\_forest\_1990,  
         world\_forest\_2016,  
         forestation  
GROUP BY 1,  
         2,  
         3  
ORDER BY 4 ASC limit 10;

#### Country-Level Detail Fill-In-the-Blank Answers

WITH country\_forest\_2016 AS  
(  
       SELECT country\_name,  
              region,  
              forest\_area\_sqkm AS forest\_2016  
       FROM   forestation  
       WHERE  year = 2016 ), country\_forest\_1990 AS  
(  
       SELECT country\_name,  
              region,  
              forest\_area\_sqkm AS forest\_1990  
       FROM   forestation  
       WHERE  year = 1990 ), joined\_2016\_1990 AS  
(  
       SELECT country\_forest\_2016.country\_name,  
              country\_forest\_2016.region,  
              country\_forest\_2016.forest\_2016,  
              country\_forest\_1990.forest\_1990  
       FROM   country\_forest\_2016  
       JOIN   country\_forest\_1990  
       ON     country\_forest\_2016.country\_name = country\_forest\_1990.country\_name )  
SELECT   country\_name,  
         region,  
         (forest\_2016 - forest\_1990) AS forest\_difference  
FROM     joined\_2016\_1990  
WHERE    forest\_2016 > forest\_1990  
ORDER BY 3 DESC limit 2

Country-Level Detail Q 1A

WITH country\_forest\_2016 AS  
(  
       SELECT country\_name,  
              region,  
              forest\_area\_sqkm AS forest\_2016  
       FROM   forestation  
       WHERE  year = 2016 ), country\_forest\_1990 AS  
(  
       SELECT country\_name,  
              region,  
              forest\_area\_sqkm AS forest\_1990  
       FROM   forestation  
       WHERE  year = 1990 ), joined\_2016\_1990 AS  
(  
       SELECT country\_forest\_2016.country\_name,  
              country\_forest\_2016.region,  
              country\_forest\_2016.forest\_2016,  
              country\_forest\_1990.forest\_1990  
       FROM   country\_forest\_2016  
       JOIN   country\_forest\_1990  
       ON     country\_forest\_2016.country\_name = country\_forest\_1990.country\_name )  
SELECT   country\_name,  
         region,  
         *Abs*(forest\_1990 - forest\_2016) AS forest\_difference  
FROM     joined\_2016\_1990  
WHERE    forest\_2016 < forest\_1990  
AND      region != 'World'  
ORDER BY 3 DESC limit 5

#### Country-Level Detail Q 1B

WITH country\_forest\_2016 AS  
(  
       SELECT country\_name,  
              percentage\_of\_forest AS percentage\_forest\_2016  
       FROM   forestation  
       WHERE  year = 2016 ), country\_forest\_1990 AS  
(  
       SELECT country\_name,  
              percentage\_of\_forest AS percentage\_forest\_1990  
       FROM   forestation  
       WHERE  year = 1990 ), joined\_2016\_1990 AS  
(  
       SELECT country\_forest\_2016.country\_name,  
              country\_forest\_2016.percentage\_forest\_2016,  
              country\_forest\_1990.percentage\_forest\_1990  
       FROM   country\_forest\_2016  
       JOIN   country\_forest\_1990  
       ON     country\_forest\_2016.country\_name = country\_forest\_1990.country\_name )  
SELECT   country\_name,  
         *Round*(((percentage\_forest\_2016 - percentage\_forest\_1990) / percentage\_forest\_1990 \* 100)::numeric,2) AS percent\_difference  
FROM     joined\_2016\_1990  
WHERE    percentage\_forest\_2016 > percentage\_forest\_1990  
ORDER BY 2 DESC limit 1

Country-Level Detail Q 1C

SELECT CASE  
         WHEN percentage\_of\_forest <= 25 THEN '0 - 25%'  
         WHEN percentage\_of\_forest > 25  
              AND percentage\_of\_forest <= 50 THEN '25 - 50%'  
         WHEN percentage\_of\_forest > 50  
              AND percentage\_of\_forest <= 75 THEN '50 - 75%'  
         WHEN percentage\_of\_forest > 75  
              AND percentage\_of\_forest <= 100 THEN '75 - 100%'  
         ELSE 'null'  
       END AS quartiles,  
       country\_name,  
       region,  
       percentage\_of\_forest  
FROM   forestation  
WHERE  year = 2016  
       AND country\_name != 'World'  
       AND percentage\_of\_forest > 75  
       AND percentage\_of\_forest <= 100  
GROUP  BY 1,  
          2,  
          3,  
          4  
ORDER  BY 4 DESC