

Report for ForestQuery into Global Deforestation, 1990 to 2016

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**By
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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 km^2** in **1990**. As of **2016**, the most recent year for which data was available, that number had fallen to **39958245.9 km^2** 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 **1279999.99 km^2**).

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 and 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 and 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
Europe & Central Asia	37.27	38.06
North America	35.65	36.04
Sub-Saharan Africa	32.19	27.47
East Asia & Pacific	25.56	26.29
South Asia	16.51	17.51
Middle East & North Africa	1.78	2.07

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 (**32.19%** to **27.47%**). 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

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 **2.62%**, much lower than the figure for China (**33.55%**).

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's** forest area increased 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	107234.00
Nigeria	Sub-Saharan Africa	106506.00
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	61.8
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**, **Mauritania** and **Honduras**. 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%	72
50% - 75%	38
75% - 100%	9

The largest number of countries in 2016 were found in the **fourth** 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
Solomon Islands	East Asia & Pacific	77.86
Seychelles	Sub-Saharan Africa	88.41
Palau	East Asia & Pacific	87.61
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Lao PDR	East Asia & Pacific	82.11
Guyana	Latin America & Caribbean	83.9
Gabon	Sub-Saharan Africa	90.04
American Samoa	East Asia & Pacific	87.5

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 World Bank data is gathered over the years **1990 - 2016** and the data shows that there was a drop of percentage of forest area during the period **3.21%** which is almost the area of Peru.



The total percentage of forest area in the world in 2016 is **31.38%**, **Latin America & Caribbean** are at top with **46.16%** and the **Middle East & North Africa** is at the bottom with just **2.07%** forest loss, which is similar to the **1990** situation.

Region	1990 Forest Percentage	2016 Forest Percentage
Latin America & Caribbean	51.03	46.16
Middle East & North Africa	1.78	2.07
World	32.42	31.38

The **Table 2.1** shows that the drop in forest area percentage was only observed in **Latin America & Caribbean** and **Sub-Saharan Africa**. All the other regions actually improved in forest area which however did not help the situation as the magnitude of decrease in the above regions was too great that it actually affected the world's forestation percentage.

- **Which countries should we focus on over others?**

China has grabbed our attention with a great increase in the forestation, and we can look deeper into the policy and attitude of the country to find out how they achieved it. Iceland is also a great example as it increased the forestation to **213.66%** but considering **China's** area it's a huge improvement and we should explore further to know how they managed it over the 16 years time.

Brazil, Indonesia, Myanmar, Nigeria and Tanzania were the greatest concerns as the decrease in the forestation square kilometers was the largest in the group with (541510, 282193.98, 107234, 106506, 102320) km^2 .

If we look at the percentage forest area decrease the countries badly affected are **TOGO, Nigeria, Uganda, Mauritania and Honduras** with 75.45%, 61.8%, 59.13%, 46.75%, 45.03%.

Sadly Nigeria seems to be in both the lists and thus provides an opportunity to implement some measures to increase forestation to improve the situation and the environment.

Only **9** countries are having more than **75%** forestation area however **85** countries lie below the **25%** of forestation mark. From the UN global forest goals we know that we require **25%** forestation area for a better ecological balance, however **33%** is a safer mark. So there are **104** countries where we need improvements which are mostly in **Sub-Saharan Africa**.



6. APPENDIX

```
-- *****
--          GLOBAL OUTLOOK          *
-- *****

CREATE OR REPLACE view forestation      AS
SELECT f.country_code                  AS code,
       f.country_name                  AS name,
       f.year                          AS YEAR,
       Round(f.forest_area_sqkm, 2)    AS fareakm2,
       Round(l.total_area_sq_mi * 2.59, 2) AS areakm2,
       r.region                        AS region,
       r.income_group                  AS incmgrp
FROM   forest_area f
JOIN   land_area l
ON     f.country_code = l.country_code
AND    f.year = l.year
JOIN   regions r
ON     l.country_code = r.country_code;

-- -----
SELECT name,
       Round(fareakm2, 2) AS fareakm2
FROM   forestation
WHERE  name = 'World'
AND    year = 1990;

-- -----
SELECT name,
       Round(fareakm2, 2) AS fareakm2
FROM   forestation
WHERE  name = 'World'
AND    year = 2016;

-- -----
WITH sub90
AS
(
```



```

        SELECT name,
               round(fareakm2, 2) AS a90
        FROM   forestation
        WHERE  name = 'World'
        AND    year = 1990 ),

sub16
AS
(
    SELECT name,
           round(fareakm2, 2) AS a16
    FROM   forestation
    WHERE  name = 'World'
    AND    year = 2016 )

SELECT name,
       Round(abs(a90 - a16), 2 )           AS difference,
       Round((abs(a90 - a16) * 100 / a90 ), 2 ) AS pdifference
FROM   sub90
JOIN   sub16
USING (name);

```

```

-----
SELECT   name,
         Round(areakm2, 2)

FROM     forestation
WHERE    areakm2 < 1324449
AND      year = 2016
AND      name != 'world'
ORDER BY areakm2 DESC
LIMIT   1;

```

```

-- *****
--          REGIONAL OUTLOOK          *
-- *****

```

```

CREATE OR REPLACE view regional
AS
SELECT f.year
       AS
       year,
       r.region,
       f.country_name
       AS country,
       Round(Sum(f.forest_area_sqkm), 2)

```

```

        AS Tforest,
        Round(Sum(l.total_area_sq_mi * 2.59), 2)
        AS Tarea,
        Round(Sum(f.forest_area_sqkm) / ( Sum(l.total_area_sq_mi) *
2.59 ) *
            100,
2) AS
pcentforestarea
FROM forest_area f
JOIN land_area l
    ON f.country_code = l.country_code
    AND f.year = l.year
JOIN regions r
    ON l.country_name = r.country_name
GROUP BY 1,
2
ORDER BY 1,
2;

```

```

-- -----
SELECT region,
        pcentforestarea
FROM regional
WHERE year = '2016'
      AND region = 'World';

```

```

-- -----
SELECT region,
        pcentforestarea
FROM regional
WHERE year = '2016'
ORDER BY pcentforestarea DESC;

```

```

-- -----
SELECT region,
        pcentforestarea
FROM regional
WHERE year = '1990'
      AND region = 'World';

```

```

-- -----
SELECT region,
        pcentforestarea

```

```

FROM    regional
WHERE   year = '1990'
ORDER  BY pcentforestarea DESC;
-- -----

-- *****
--          COUNTRY OUTLOOK          *
-- *****

WITH con90
AS
(
    SELECT f.country_code,
           f.country_name,
           f.year,
           f.forest_area_sqkm AS a90
    FROM   forest_area f
    WHERE  f.year = '1990'
    AND    f.forest_area_sqkm IS NOT NULL
    AND    f.country_name != 'World' ),
con16
AS
(
    SELECT f.country_code,
           f.country_name,
           f.year,
           f.forest_area_sqkm AS a16
    FROM   forest_area f
    WHERE  f.year = '2016'
    AND    f.forest_area_sqkm IS NOT NULL
    AND    f.country_name != 'World' )
SELECT  con16.country_name,
        r.region,

con90.a90 AS area90,
Con16.a16 AS area16,
Round( (con90.a90 - con16.a16), 2 ) AS difference,
Round( ( abs(con90.a90 - con16.a16) * 100 / con90.a90 ), 2 ) AS
pdifference
FROM    con90
JOIN    con16
ON      con90.country_code = con16.country_code
JOIN    regions r

```

```

ON          con16.country_code = r.country_code
ORDER BY difference;

-----
WITH con90
AS
(
    SELECT f.country_code,
           f.country_name,
           f.year,
           f.forest_area_sqkm AS a90
    FROM   forest_area f
    WHERE  f.year = '1990'
    AND    f.forest_area_sqkm IS NOT NULL
    AND    f.country_name != 'World' ),
con16
AS
(
    SELECT f.country_code,
           f.country_name,
           f.year,
           f.forest_area_sqkm AS a16
    FROM   forest_area f
    WHERE  f.year = '2016'
    AND    f.forest_area_sqkm IS NOT NULL
    AND    f.country_name != 'World' )
SELECT   con16.country_name,
          r.region,
          con90.a90
AS area90,
          con16.a16
AS area16,
          round( (con90.a90 - con16.a16), 2 )
AS difference,
          round( ( abs(con90.a90 - con16.a16) * 100 / con90.a90 ), 2
) AS pdifference
FROM     con90
JOIN     con16
ON       con90.country_code = con16.country_code
JOIN     regions r
ON       con16.country_code = r.country_code
ORDER BY pdifference DESC
LIMIT    5;

```

```

-----
WITH con90
AS
(
    SELECT f.country_code,
           f.country_name,
           f.year,
           f.forest_area_sqkm AS a90
    FROM   forest_area f
    WHERE  f.year = '1990'
    AND    f.forest_area_sqkm IS NOT NULL
    AND    f.country_name != 'World' ),
con16
AS
(
    SELECT f.country_code,
           f.country_name,
           f.year,
           f.forest_area_sqkm AS a16
    FROM   forest_area f
    WHERE  f.year = '2016'
    AND    f.forest_area_sqkm IS NOT NULL
    AND    f.country_name != 'World' )
SELECT   con16.country_name,
         r.region,
con90.a90 AS area90,
con16.a16 AS area16,
round( (con90.a90 - con16.a16), 2 ) AS difference,
round( ( abs(con90.a90 - con16.a16) * 100 / con90.a90 ), 2 ) AS
pdifference
FROM     con90
JOIN     con16
ON       con90.country_code = con16.country_code
JOIN     regions r
ON       con16.country_code = r.country_code
ORDER BY difference DESC
LIMIT    5;

```

```

-----

```

```

WITH con90

```

```

AS

```

```

(

```

```

        SELECT f.country_code,
               f.country_name,
               f.year,
               f.forest_area_sqkm AS a90
    FROM forest_area f
   WHERE f.year = '1990'
   AND    f.forest_area_sqkm IS NOT NULL
   AND    f.country_name != 'World' ),
    con16
AS
(
    SELECT f.country_code,
           f.country_name,
           f.year,
           f.forest_area_sqkm AS a16
    FROM forest_area f
   WHERE f.year = '2016'
   AND    f.forest_area_sqkm != 0
   AND    f.country_name != 'World' )
SELECT    con16.country_name,
           r.region,

round(con90.a90, 2) AS area90,

round(con16.a16, 2) AS area16,
round( (con90.a90 - con16.a16), 2 ) AS difference,
round( ( (con16.a16 - con90.a90) / con90.a90 * 100 ), 2 ) AS
pdifference
    FROM    con90
   JOIN    con16
   ON      con90.country_code = con16.country_code
   AND     (
               con90.a90 != 0
           AND    con16.a16 != 0 )
   JOIN    regions r
   ON      con16.country_code = r.country_code
ORDER BY 6
LIMIT    5;

```

```

-- *****
--          QUARTILE OUTLOOK          *
-- *****

```

```

WITH tab1
  AS (SELECT f.country_code           AS code,
            f.country_name           AS NAME,
            f.year                    AS year,
            Round(f.forest_area_sqkm, 2) AS fareakm2,
            Round(l.total_area_sq_mi * 2.59, 2) AS areakm2,
            r.region                  AS region,
            r.income_group            AS incmgrp
  FROM   forest_area f
        JOIN land_area l
          ON f.country_code = l.country_code
          AND f.year = l.year
        JOIN regions r
          ON l.country_code = r.country_code
 WHERE  f.country_name != 'World'
        AND f.year = '2016'
        AND f.forest_area_sqkm != 0),

tab2
  AS (SELECT NAME,
            region,
            fareakm2,
            areakm2,
            Round(Cast(( fareakm2 * 100 / areakm2 ) AS FLOAT), 2) AS pcentfarea,
            CASE
WHEN Round(Cast((fareakm2*100 /areakm2) AS FLOAT), 2)>= 75 THEN 4
WHEN          Round(Cast((fareakm2*100/areakm2)AS          FLOAT),2)<=75
AND Round(Cast(( fareakm2 * 100 / areakm2 ) AS FLOAT), 2) >= 50 THEN 3
WHEN Round(Cast(( fareakm2 * 100 / areakm2 ) AS FLOAT), 2) <=50 AND
Round(Cast(( fareakm2 * 100 / areakm2 ) AS FLOAT), 2) >= 25m THEN 2
ELSE 1
            END AS QUARTILE
  FROM   tab1
 WHERE  NAME != 'World'
        AND year = '2016'
        AND fareakm2 != 0
        ORDER BY quartile)
SELECT tab2.quartile,
       Count(tab2.quartile)
FROM   tab2
GROUP BY 1
ORDER BY 1;

```

```

WITH tab1
  AS (SELECT f.country_code           AS code,
            f.country_name           AS NAME,
            f.year                    AS year,
            Round(f.forest_area_sqkm, 2) AS fareakm2,
            Round(l.total_area_sq_mi * 2.59, 2) AS areakm2,
            r.region                  AS region,
            r.income_group            AS incmgrp
  FROM   forest_area f
        JOIN land_area l
          ON f.country_code = l.country_code
          AND f.year = l.year
        JOIN regions r
          ON l.country_code = r.country_code
 WHERE  f.country_name != 'World'
        AND f.year = '2016'
        AND f.forest_area_sqkm != 0),

tab2
  AS (SELECT NAME,
            region,
            fareakm2,
            areakm2,
            Round(Cast(( fareakm2 * 100 / areakm2 ) AS FLOAT), 2)

AS

            pcentfarearea,
            CASE
              WHEN Round(Cast(( fareakm2 * 100 / areakm2 ) AS
FLOAT), 2) >=
                75
              THEN
                4
              WHEN Round(Cast(( fareakm2 * 100 / areakm2 ) AS
FLOAT), 2) <=
                75
                AND Round(Cast(( fareakm2 * 100 / areakm2 ) AS
FLOAT), 2)
                  >=
                    50
              THEN 3
              WHEN Round(Cast(( fareakm2 * 100 / areakm2 ) AS
FLOAT), 2) <=
                50

```



```

                                AND Round(Cast(( fareakm2 * 100 / areakm2 ) AS
FLOAT), 2)
                                >=
                                25
                                THEN 2
                                ELSE 1
END

```

AS

```

                                QUARTILE
FROM      tab1
WHERE     NAME != 'World'
          AND year = '2016'
          AND fareakm2 != 0
          ORDER BY quartile)
SELECT NAME,
       region,
       pcentfarearea,
       tab2.quartile
FROM    tab2
WHERE   quartile = 4
ORDER  BY 3;

```

```

-- *****
--      How Many Countries Above USA      *
-- *****

```

WITH tab1

```

AS (SELECT f.country_code           AS code,
          f.country_name           AS NAME,
          f.year                   AS year,
          Round(f.forest_area_sqkm, 2) AS fareakm2,
          Round(l.total_area_sq_mi * 2.59, 2) AS areakm2,
          r.region                 AS region,
          r.income_group           AS incmgrp
FROM      forest_area f
JOIN      land_area l
          ON f.country_code = l.country_code
          AND f.year = l.year
JOIN      regions r
          ON l.country_code = r.country_code
WHERE     f.country_name != 'World'
          AND f.year = '2016'
          AND f.forest_area_sqkm != 0),

```

```

tab2
AS (SELECT NAME,
          region,
          fareakm2,
          areakm2,
          Round(Cast(( fareakm2 * 100 / areakm2 ) AS FLOAT), 2)
AS
          pcentfarearea,
          CASE
            WHEN Round(Cast(( fareakm2 * 100 / areakm2 ) AS
FLOAT), 2) >=
              75
            THEN
              4
            WHEN Round(Cast(( fareakm2 * 100 / areakm2 ) AS
FLOAT), 2) <=
              75
              AND Round(Cast(( fareakm2 * 100 / areakm2 ) AS
FLOAT), 2)
                >=
                  50
            THEN 3
            WHEN Round(Cast(( fareakm2 * 100 / areakm2 ) AS
FLOAT), 2) <=
              50
              AND Round(Cast(( fareakm2 * 100 / areakm2 ) AS
FLOAT), 2)
                >=
                  25
            THEN 2
            ELSE 1
          END
AS
          QUARTILE
FROM tab1
WHERE NAME != 'World'
      AND year = '2016'
      AND fareakm2 != 0
      ORDER BY quartile)
SELECT Count(NAME)
FROM tab2
WHERE pcentfarearea > (SELECT pcentfarearea
                       FROM tab2

```

```
WHERE tab2.NAME = 'United States');
```

7. RESOURCES

<https://github.com/techi28/Data-Science/blob/main/BDefrostation.sql>