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 in 1990. As of 2016, the most recent year for which data was available, that number had fallen to39958245.90 , a loss of 1324449.00 , 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 ).

## 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.

Figure 2.1: Country Details Forest Area Change Percentage, 1990 & 2016:

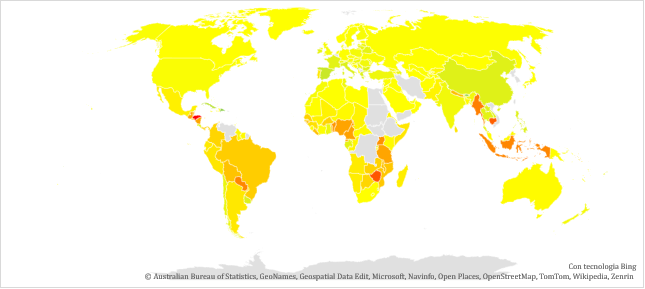


Table 2.1: Percent Forest Area by Region, 1990 & 2016:

|  |  |  |  |
| --- | --- | --- | --- |
| Region | 1990 Forest In % | 2016 Forest In % | Forest Area Change In % |
| Latin America & Caribbean | 51.03 | 46.16 | -4.87 |
| Europe & Central Asia | 37.27 | 38.06 | 0.79 |
| North America | 35.65 | 36.04 | 0.39 |
| World | 32.42 | 31.38 | -1.04 |
| Sub-Saharan Africa | 32.19 | 27.56 | -4.63 |
| East Asia & Pacific | 25.77 | 26.36 | 0.59 |
| South Asia | 16.51 | 17.51 | 1.00 |
| Middle East & North Africa | 1.78 | 2.07 | 0.29 |

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 27.56%). 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 79200.00., much lower than the figure for China.

China and Russian Federation 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 68% from 1990 to 2016.

Table 3.1: Top 5 Increase in Forest Area by Country, 1990 & 2016:

|  |  |  |  |
| --- | --- | --- | --- |
| Region | Country | Total Area 2016 In | Forest Area Change In |
| East Asia & Pacific | China | 9388210.01 | 527229.06 |
| North America | United States | 9147419.99 | 79200.00 |
| South Asia | India | 2973190.01 | 69213.98 |
| Europe & Central Asia | Russian Federation | 16376870.00 | 59395.00 |
| East Asia & Pacific | Vietnam | 310070.01 | 55390.00 |

Table 3.2: Top 5 Increase in Forest Area percentage by Country, 1990 & 2016:

|  |  |  |  |
| --- | --- | --- | --- |
| Region | Country | Total Area 2016 In | Forest Area Change In % |
| Europe & Central Asia | Iceland | 100249.99 | 68 |
| East Asia & Pacific | French Polynesia | 3660.01 | 65 |
| Middle East & North Africa | Bahrain | 778.01 | 64 |
| Latin America & Caribbean | Uruguay | 175020.00 | 57 |
| Middle East & North Africa | Kuwait | 17820.00 | 45 |

### 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 3.3: Top 3 Amount Decrease in Forest Area by Country, 1990 & 2016:

|  |  |  |  |
| --- | --- | --- | --- |
| Region | Country | Total Area 2016 In | Absolute Forest Area Change |
| Latin America & Caribbean | Brazil | 8358140.00 | 541510.00 |
| East Asia & Pacific | Indonesia | 1811570.01 | 282193.98 |
| East Asia & Pacific | Myanmar | 653080.00 | 107234.00 |

The second way to consider which countries are of concern is to analyze the data by percent decrease.

Table 3.4: Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016:

|  |  |  |  |
| --- | --- | --- | --- |
| Region | Country | Total Area 2016 In | Pct Forest Area Change |
| Sub-Saharan Africa | Togo | 54390.00 | 75 |
| Sub-Saharan Africa | Nigeria | 910770.00 | 62 |
| Sub-Saharan Africa | Uganda | 200520.00 | 59 |
| Sub-Saharan Africa | Mauritania | 1030700.01 | 47 |
| Latin America & Caribbean | Honduras | 111889.99 | 45 |

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.

### QUARTILES

Table 3.5: Count of Countries Grouped by Forestation Percent Quartiles, 2016:

|  |  |
| --- | --- |
| Quartile | Number of Countries |
| 1 | 85 |
| 2 | 72 |
| 3 | 38 |
| 4 | 9 |

The largest number of countries in 2016 were found in the 1 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 3.6: Top Quartile Countries, 2016:

|  |  |  |
| --- | --- | --- |
| Region | Country | Pct Designated as Forest |
| Latin America & Caribbean | Suriname | 98.26 |
| East Asia & Pacific | Micronesia, Fed. Sts. | 91.86 |
| Sub-Saharan Africa | Gabon | 90.04 |
| Sub-Saharan Africa | Seychelles | 88.41 |
| East Asia & Pacific | Palau | 87.61 |
| East Asia & Pacific | American Samoa | 87.50 |
| Latin America & Caribbean | Guyana | 83.90 |
| East Asia & Pacific | Lao PDR | 82.11 |
| East Asia & Pacific | Solomon Islands | 77.86 |

## 4. RECOMMENDATIONS

*Write out a set of recommendations as an analyst on the ForestQuery team.*

* *What have you learned from the World Bank data?*

*From the analysis conducted, it is evident that countries that have driven capitalism, such as the United States and China, have taken some remedial actions during the analyzed period by increasing their forestation percentages compared to 1990. It is also clear that the countries bearing the brunt of the current production system are those that are less economically developed and more affected by desertification. It would be intriguing to analyze a broader spectrum of data, spanning at least a century, to understand the impact of the current production system on resources such as forests. In the final analysis, the overall picture remains negative at a global level. The major powers have indeed intervened, but in my opinion, if we look back to data from the beginning of the century, the balance will likely not be positive.*

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

*In continuity with the previous answer, I believe that attention should be focused on former colonial countries in the Sub-Saharan Africa region. Nigeria is a striking example, being a territory rich in natural and mineral resources but economically poor and politically unstable. Despite the encouraging results regarding China and the United States, it is important to highlight that China plays a significant role in Nigeria, having recently promoted multiple economic initiatives and investments in that country. What does not emerge from the data, but is part of a broader context, is how certain countries tend to export their "dirt" beyond their own borders, to the detriment of developing nations. In conclusion, the global data on this issue (which is part of a much larger context) sends a clear message: the entire world is at a significant loss. It does not matter if this or that country shows a positive result over a decade by exploiting the resources of another country for production and profit; we are all on the same planet.*

## 5. APPENDIX: SQL Queries Used

CREATE OR REPLACE VIEW forestation AS

WITH t0 AS (

    SELECT

        r.country\_name,

        r.country\_code,

        r.region,

        r.income\_group,

        la.year,

        la.total\_area\_sq\_mi::numeric \* 2.59 AS total\_area\_sq\_km,

        fa.forest\_area\_sqkm AS forest\_area\_sq\_km

    FROM

        regions r

    JOIN

        land\_area la ON r.country\_code = la.country\_code

        AND COALESCE(la.total\_area\_sq\_mi, 0::double precision) <> 0::double precision

    JOIN

        forest\_area fa ON la.country\_code = fa.country\_code

        AND la.year = fa.year

        AND fa.forest\_area\_sqkm IS NOT NULL

)

SELECT

    country\_name,

    country\_code,

    region,

    income\_group,

    year,

    total\_area\_sq\_km,

    forest\_area\_sq\_km,

    forest\_area\_sq\_km / total\_area\_sq\_km::double precision \* 100::double precision AS perc\_land\_designed\_as\_forest\_sq\_km

FROM

    t0;

-- 1. GLOBAL SITUATION

-- G\_Q1 - According to the World Bank, what was the total forest area of the world in 1990?

-- G\_Q2 - As of 2016, the most recent year for which data was available, what had that number fallen to?

-- G\_Q3 - As of 2016, the most recent year for which data was available, what was the loss in absolute terms?

-- G\_Q4 - As of 2016, the most recent year for which data was available, what was the loss in percentage terms?

-- G\_Q5 - The forest area lost over this time period is slightly more than the entire land area of which country listed for the year 2016?

-- G\_Q6 - What was the entire land area of that country listed for the year 2016?

WITH t0 AS (

    SELECT

        "year",

        ROUND(SUM(forest\_area\_sq\_km::numeric), 2) AS sum\_forest\_area\_sq\_km

    FROM

        forestation f

    WHERE

        "year" IN (1990, 2016)

        AND country\_name = 'World'

    GROUP BY

        "year"

),

t1 AS (

    SELECT

        MAX(CASE WHEN "year" = 1990 THEN sum\_forest\_area\_sq\_km END) AS sum\_forest\_area\_sq\_km\_1990,

        MAX(CASE WHEN "year" = 2016 THEN sum\_forest\_area\_sq\_km END) AS sum\_forest\_area\_sq\_km\_2016

    FROM

        t0

),

t2 AS (

    SELECT

        sum\_forest\_area\_sq\_km\_1990,

        sum\_forest\_area\_sq\_km\_2016,

        sum\_forest\_area\_sq\_km\_1990 - sum\_forest\_area\_sq\_km\_2016 AS forest\_area\_lost\_1990\_to\_2016\_sq\_km,

        ROUND(((sum\_forest\_area\_sq\_km\_1990 - sum\_forest\_area\_sq\_km\_2016)/sum\_forest\_area\_sq\_km\_1990\*100)::numeric, 2) AS forest\_area\_lost\_1990\_to\_2016\_perc

    FROM

        t1

),

t3 AS (

    SELECT

        sum\_forest\_area\_sq\_km\_1990,

        sum\_forest\_area\_sq\_km\_2016,

        forest\_area\_lost\_1990\_to\_2016\_sq\_km,

        forest\_area\_lost\_1990\_to\_2016\_perc,

        f2.country\_name AS country\_eq\_name,

        ROUND(f2.total\_area\_sq\_km, 2) AS country\_eq\_total\_area\_sq\_km

    FROM

        t2

    JOIN

        forestation f2

    ON

        t2.forest\_area\_lost\_1990\_to\_2016\_sq\_km >= f2.total\_area\_sq\_km

        AND f2."year" = 2016

    ORDER BY

        f2.total\_area\_sq\_km DESC

    LIMIT 1

)

SELECT

    sum\_forest\_area\_sq\_km\_1990 AS G\_Q1,

    sum\_forest\_area\_sq\_km\_2016 AS G\_Q2,

    forest\_area\_lost\_1990\_to\_2016\_sq\_km AS G\_Q3,

    forest\_area\_lost\_1990\_to\_2016\_perc AS G\_Q4,

    country\_eq\_name AS G\_Q5,

    country\_eq\_total\_area\_sq\_km AS G\_Q6

FROM

    t3;

-- 2. REGIONAL OUTLOOK

-- 2\_Q1 - Figure 2.1: Country Details Forest Area Change Percentage, 1990 & 2016:

WITH t1 AS (

    SELECT

        f1.region,

        f1.country\_name,

        ROUND((SUM(f1.forest\_area\_sq\_km)/SUM(f1.total\_area\_sq\_km)\*100)::numeric, 2) AS forest\_percentage\_in\_1990

    FROM

        forestation f1

    WHERE

        f1."year" = 1990

    GROUP BY

        f1.region, f1.country\_name

),

t2 AS (

    SELECT

        f2.region,

        f2.country\_name,

        ROUND((SUM(f2.forest\_area\_sq\_km)/SUM(f2.total\_area\_sq\_km)\*100)::numeric, 2) AS forest\_percentage\_in\_2016

    FROM

        forestation f2

    WHERE

        f2."year" = 2016

    GROUP BY

        f2.region, f2.country\_name

)

SELECT

    t1.country\_name,

    t2.forest\_percentage\_in\_2016 - t1.forest\_percentage\_in\_1990 AS forest\_area\_change\_in\_perc

FROM

    t1

JOIN

    t2

ON

    t1.region = t2.region

    AND t1.country\_name = t2.country\_name

ORDER BY

    2 DESC;

-- 2\_Q2 - Table 2.1: Percent Forest Area by Region, 1990 & 2016

WITH t1 AS (

    SELECT

        f1.region,

        ROUND((SUM(f1.forest\_area\_sq\_km)/SUM(f1.total\_area\_sq\_km)\*100)::numeric, 2) AS forest\_percentage\_in\_1990

    FROM

        forestation f1

    WHERE

        f1."year" = 1990

    GROUP BY

        f1.region

),

t2 AS (

    SELECT

        f2.region,

        ROUND((SUM(f2.forest\_area\_sq\_km)/SUM(f2.total\_area\_sq\_km)\*100)::numeric, 2) AS forest\_percentage\_in\_2016

    FROM

        forestation f2

    WHERE

        f2."year" = 2016

    GROUP BY

        f2.region

)

SELECT

    t1.region,

    t1.forest\_percentage\_in\_1990,

    t2.forest\_percentage\_in\_2016,

    t2.forest\_percentage\_in\_2016 - t1.forest\_percentage\_in\_1990 AS forest\_area\_change\_in\_perc

FROM

    t1

JOIN

    t2

ON

    t1.region = t2.region

ORDER BY

    2 DESC, 3 DESC;

-- 3. COUNTRY-LEVEL DETAIL

-- 3.A. SUCCESS STORIES

-- 3\_A\_Q1 Top 5 Increase in Forest Area by Country, 1990 & 2016

WITH t1 AS (

    SELECT

        f1.region,

        f1.country\_name,

        ROUND(SUM(f1.forest\_area\_sq\_km::numeric), 2) AS forest\_area\_in\_1990

    FROM

        forestation f1

    WHERE

        f1."year" = 1990

    GROUP BY

        f1.region, f1.country\_name

),

t2 AS (

    SELECT

        f2.region,

        f2.country\_name,

        ROUND(SUM(f2.total\_area\_sq\_km), 2) AS total\_area\_sq\_km\_in\_2016,

        ROUND(SUM(f2.forest\_area\_sq\_km::numeric), 2) AS forest\_area\_in\_2016

    FROM

        forestation f2

    WHERE

        f2."year" = 2016

    GROUP BY

        f2.region, f2.country\_name

)

SELECT

    t1.region,

    t1.country\_name,

    t2.total\_area\_sq\_km\_in\_2016,

    t2.forest\_area\_in\_2016 - t1.forest\_area\_in\_1990 AS forest\_area\_change

FROM

    t1

JOIN

    t2

ON

    t1.region = t2.region

    AND t1.country\_name = t2.country\_name

WHERE

    t2.forest\_area\_in\_2016 - t1.forest\_area\_in\_1990 > 0

    AND t1.region <> 'World'

ORDER BY

    4 DESC

LIMIT 5;

-- 3\_A\_Q2 Top 5 Increase in Forest Area percentage by Country, 1990 & 2016

WITH t1 AS (

    SELECT

        f1.region,

        f1.country\_name,

        ROUND(SUM(f1.forest\_area\_sq\_km::numeric), 2) AS forest\_area\_in\_1990

    FROM

        forestation f1

    WHERE

        f1."year" = 1990

    GROUP BY

        f1.region, f1.country\_name

),

t2 AS (

    SELECT

        f2.region,

        f2.country\_name,

        ROUND(SUM(f2.total\_area\_sq\_km), 2) AS total\_area\_sq\_km\_in\_2016,

        ROUND(SUM(f2.forest\_area\_sq\_km::numeric), 2) AS forest\_area\_in\_2016

    FROM

        forestation f2

    WHERE

        f2."year" = 2016

    GROUP BY

        f2.region, f2.country\_name

)

SELECT

    t1.region,

    t1.country\_name,

    t2.total\_area\_sq\_km\_in\_2016,

    ROUND((1 - (t1.forest\_area\_in\_1990 / t2.forest\_area\_in\_2016)) \* 100) AS abs\_forest\_area\_change

FROM

    t1

JOIN

    t2

ON

    t1.region = t2.region

    AND t1.country\_name = t2.country\_name

WHERE

    t2.forest\_area\_in\_2016 > t1.forest\_area\_in\_1990

    AND t1.region <> 'World'

ORDER BY

    4 DESC

LIMIT 5;

-- 3.B. LARGEST CONCERNS

-- 3\_B\_Q1 Top 5 Increase in Forest Area by Country, 1990 & 2016

WITH t1 AS (

    SELECT

        f1.region,

        f1.country\_name,

        ROUND(SUM(f1.forest\_area\_sq\_km::numeric), 2) AS forest\_area\_in\_1990

    FROM

        forestation f1

    WHERE

        f1."year" = 1990

    GROUP BY

        f1.region, f1.country\_name

),

t2 AS (

    SELECT

        f2.region,

        f2.country\_name,

        ROUND(SUM(f2.total\_area\_sq\_km), 2) AS total\_area\_sq\_km\_in\_2016,

        ROUND(SUM(f2.forest\_area\_sq\_km::numeric), 2) AS forest\_area\_in\_2016

    FROM

        forestation f2

    WHERE

        f2."year" = 2016

    GROUP BY

        f2.region, f2.country\_name

)

SELECT

    t1.region,

    t1.country\_name,

    t2.total\_area\_sq\_km\_in\_2016,

    ABS(t2.forest\_area\_in\_2016 - t1.forest\_area\_in\_1990) AS abs\_forest\_area\_change

FROM

    t1

JOIN

    t2

ON

    t1.region = t2.region

    AND t1.country\_name = t2.country\_name

WHERE

    t2.forest\_area\_in\_2016 < t1.forest\_area\_in\_1990

    AND t1.region <> 'World'

ORDER BY

    4 DESC

LIMIT 3;

-- 3\_B\_Q2 Top 5 Increase in Forest Area percentage by Country, 1990 & 2016

WITH t1 AS (

    SELECT

        f1.region,

        f1.country\_name,

        ROUND(SUM(f1.forest\_area\_sq\_km::numeric), 2) AS forest\_area\_in\_1990

    FROM

        forestation f1

    WHERE

        f1."year" = 1990

    GROUP BY

        f1.region, f1.country\_name

),

t2 AS (

    SELECT

        f2.region,

        f2.country\_name,

        ROUND(SUM(f2.total\_area\_sq\_km), 2) AS total\_area\_sq\_km\_in\_2016,

        ROUND(SUM(f2.forest\_area\_sq\_km::numeric), 2) AS forest\_area\_in\_2016

    FROM

        forestation f2

    WHERE

        f2."year" = 2016

    GROUP BY

        f2.region, f2.country\_name

)

SELECT

    t1.region,

    t1.country\_name,

    t2.total\_area\_sq\_km\_in\_2016,

    ROUND((1 - (t2.forest\_area\_in\_2016 / t1.forest\_area\_in\_1990)) \* 100) AS abs\_forest\_area\_change

FROM

    t1

JOIN

    t2

ON

    t1.region = t2.region

    AND t1.country\_name = t2.country\_name

WHERE

    t2.forest\_area\_in\_2016 < t1.forest\_area\_in\_1990

    AND t1.region <> 'World'

ORDER BY

    4 DESC

LIMIT 5;

-- 3.C. QUARTILES

-- 3\_C\_Q1 Table 3.5: Count of Countries Grouped by Forestation Percent Quartiles, 2016

WITH t0 AS (

    SELECT

        country\_name,

        region,

        perc\_land\_designed\_as\_forest\_sq\_km,

        CASE

            WHEN ROUND(perc\_land\_designed\_as\_forest\_sq\_km::numeric, 2) BETWEEN 75 AND 100 THEN 4

            WHEN ROUND(perc\_land\_designed\_as\_forest\_sq\_km::numeric, 2) BETWEEN 50 AND 75 THEN 3

            WHEN ROUND(perc\_land\_designed\_as\_forest\_sq\_km::numeric, 2) BETWEEN 25 AND 50 THEN 2

            WHEN ROUND(perc\_land\_designed\_as\_forest\_sq\_km::numeric, 2) BETWEEN 0 AND 25 THEN 1

        END AS quartile

    FROM

        forestation f

    WHERE

        f."year" = 2016

        AND f.country\_name <> 'World'

        AND perc\_land\_designed\_as\_forest\_sq\_km IS NOT NULL

)

SELECT

    quartile,

    COUNT(\*) AS number\_of\_countries

FROM

    t0

GROUP BY

    quartile

ORDER BY

    quartile ASC;

-- 3\_C\_Q2 Table 3.6: Top Quartile Countries, 2016

WITH t0 AS (

    SELECT

        country\_name,

        region,

        perc\_land\_designed\_as\_forest\_sq\_km,

        CASE

            WHEN ROUND(perc\_land\_designed\_as\_forest\_sq\_km::numeric, 2) BETWEEN 75 AND 100 THEN 4

            WHEN ROUND(perc\_land\_designed\_as\_forest\_sq\_km::numeric, 2) BETWEEN 50 AND 75 THEN 3

            WHEN ROUND(perc\_land\_designed\_as\_forest\_sq\_km::numeric, 2) BETWEEN 25 AND 50 THEN 2

            WHEN ROUND(perc\_land\_designed\_as\_forest\_sq\_km::numeric, 2) BETWEEN 0 AND 25 THEN 1

        END AS quartile

    FROM

        forestation f

    WHERE

        f."year" = 2016

        AND f.country\_name <> 'World'

        AND perc\_land\_designed\_as\_forest\_sq\_km IS NOT NULL

)

SELECT

    region,

    country\_name,

    ROUND(perc\_land\_designed\_as\_forest\_sq\_km::numeric, 2) AS pct\_designated\_as\_forest

FROM

    t0

WHERE

    quartile = 4

ORDER BY

    3 DESC;