

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 sqkm** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9**, a loss of **1324449.0 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 **1279999.9891 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 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 **1.7%** forestation.

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

Region	1990 Forest Percentage	2016 Forest Percentage
Middle East & North Africa	1.78	2.07
South Asia	16.51	17.51
East Asia & Pacific	25.78	26.36
Sub-Saharan Africa	30.67	28.79
World	32.42	31.38
North America	35.65	36.04
Europe & Central Asia	37.28	38.04
Latin America & Caribbean	51.03	46.16

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

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 **527229.062sqkm**. 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 **79200sqkm**, 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.

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	282194
Myanmar	East Asia & Pacific	107234
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.

C. QUARTILES

Table 3.3: Count of Countries Grouped by Forestation Percent Quartiles, 2016:

Quartile	Number of Countries
Q1	85
Q2	73
Q3	38
Q4	9

The largest number of countries in 2016 were found in the 1st 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
Solomon Islands	East Asia & Pacific	77.86
Lao PDR	East Asia & Pacific	82.11
Guyana	Latin America & Caribbean	83.9
American Samoa	East Asia & Pacific	87.5
Palau	East Asia & Pacific	87.61
Seychelles	Sub-Saharan Africa	88.41
Gabon	Sub-Saharan Africa	90.04
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Suriname	Latin America & Caribbean	98.26

4. RECOMMENDATIONS

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

- What have you learned from the World Bank data?
The total forest has decreased by 3.21% globally from 1990 to 2016 but are some some bright spots. China increased its forest area from 1990 to 2016 by **527229.062sqkm**.
Iceland increased in forest area by **213.66%** from 1990 to 2016.
- Which countries should we focus on over others?

We should focus on Sub-Saharan Africa and Latin America & Caribbean region countries(Togo, Nigeria, Uganda, Mauritania and Honduras)

5. APPENDIX: SQL queries used

```
--Create a View called "forestation" by joining all three tables -
forest_area, land_area and regions
CREATE VIEW forestation AS
select
    fa.country_code,
    fa.country_name,
    fa.year,
    fa.forest_area_sqkm,
    la.total_area_sq_mi,
    r.region,
    r.income_group,
    ROUND((100*forest_area_sqkm/(total_area_sq_mi*2.59))::NUMERIC, 2)
forest_percent
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;

--Global situation
--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
    forest_area_sqkm
FROM forestation
where region='World' and year='1990';

--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
    forest_area_sqkm
FROM forestation
where region='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
        region,
        forest_area_sqkm
    FROM forestation
    WHERE region='World' and year='1990'
),
t2 AS (
    SELECT
        region,
        forest_area_sqkm
    FROM forestation
    where region='World' and year='2016'
)
SELECT t1.forest_area_sqkm - t2.forest_area_sqkm from t1 join t2 on
t1.region = t2.region;
```

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

```
WITH t1 AS (
    SELECT
        region,
        forest_area_sqkm
    FROM forestation
    WHERE region='World' and year='1990'
),
t2 AS (
    SELECT
        region,
        forest_area_sqkm
    FROM forestation
    where region='World' and year='2016'
)
SELECT ROUND(CAST( 100*(t1.forest_area_sqkm -
t2.forest_area_sqkm)/t1.forest_area_sqkm AS NUMERIC), 2) from t1 join
t2 on t1.region = t2.region;
```

--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  
        region,  
        forest_area_sqkm  
    FROM forestation  
    WHERE region='World' and year='1990'  
) ,  
t2 AS (  
    SELECT  
        region,  
        forest_area_sqkm  
    FROM forestation  
    where region='World' and year='2016'  
) ,  
t3 AS ( SELECT t1.forest_area_sqkm - t2.forest_area_sqkm from t1 join  
t2 ON t1.region = t2.region )  
SELECT country_name, abs(total_area_sq_mi*2.59 - (SELECT * FROM t3) )  
FROM forestation  
order by 2  
LIMIT 1;
```

--REGIONAL OUTLOOK

--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 t1 AS (  
    SELECT region, YEAR, ROUND(CAST(100*SUM(forest_area_sqkm) /  
SUM(total_area_sq_mi*2.59) AS NUMERIC), 2) forest_percent_1990  
    FROM forestation  
    WHERE YEAR = '1990'  
    GROUP BY region , YEAR  
) ,  
t2 AS (  
    SELECT region, YEAR, ROUND(CAST(100*SUM(forest_area_sqkm) /  
SUM(total_area_sq_mi*2.59) AS NUMERIC), 2) forest_percent_2016
```

```

        FROM forestation
        WHERE YEAR = '2016'
        GROUP BY region , YEAR
    )
    SELECT t1.region, forest_percent_1990, forest_percent_2016 from t1
    JOIN t2 ON t1.region = t2.region
    ORDER BY 2, 1;

--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?
--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
                region,
                country_name,
                forest_area_sqkm AS forest_area_1990
            FROM forestation
            WHERE year = '1990' AND region <> 'World' ),
t2 AS ( select
                region,
                country_name,
                forest_area_sqkm AS forest_area_2016
            FROM forestation
            WHERE year = '2016' AND region <> 'World')
SELECT
    t1.country_name,
    t1.region,
    t2.forest_area_1990 - t2.forest_area_2016,
    ROUND((100*(t1.forest_area_1990 - t2.forest_area_2016)/
t1.forest_area_1990)::NUMERIC, 2) percent_decrease
FROM t1 JOIN t2
on t1.country_name = t2.country_name and t1.region = t2.region
WHERE t1.forest_area_1990 > t2.forest_area_2016
ORDER by 3 desc
LIMIT 5

WITH t1 AS (select
                region,
                country_name,
                forest_area_sqkm AS forest_area_1990
            FROM forestation
            WHERE year = '1990' AND region <> 'World' ),

```



```

t2 AS ( select
            region,
            country_name,
            forest_area_sqkm AS forest_area_2016
        FROM forestation
        WHERE year = '2016' AND region <> 'World')

SELECT
    t1.country_name,
    t1.region,
    t1.forest_area_1990 - t2.forest_area_2016,
    ROUND((100*(t2.forest_area_2016 - t1.forest_area_1990)/
t1.forest_area_1990)::NUMERIC, 2) percent_increase
FROM t1 JOIN t2
on t1.country_name = t2.country_name and t1.region = t2.region
WHERE t1.forest_area_1990 < t2.forest_area_2016
ORDER by 3 desc
LIMIT 5;

with t1 as (
    select CASE WHEN forest_percent <= 25 then "Q1"
                WHEN forest_percent > 25 and forest_percent <= 50
THEN "Q2"
                WHEN forest_percent > 50 and forest_percent <= 75
THEN "Q3"
                WHEN forest_percent > 75 THEN "Q4" END
    from forestation
)

select  country_name, region, forest_percent from (
    select country_name, region, forest_percent, CASE WHEN
forest_percent <= 25 then 'Q1'
                WHEN forest_percent > 25 and forest_percent <= 50
THEN 'Q2'
                WHEN forest_percent > 50 and forest_percent <= 75
THEN 'Q3'
                WHEN forest_percent > 75 THEN 'Q4' END as
forest_quartile
    from forestation
    where year='2016' and forest_percent is not null
) sub

where forest_quartile='Q4'
order by 3

```

