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DEFORESTATION EXPLORATION

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REPORT FOR FORESTQUERY INTO GLOBAL DEFORESTATION, 1990 TO 2016

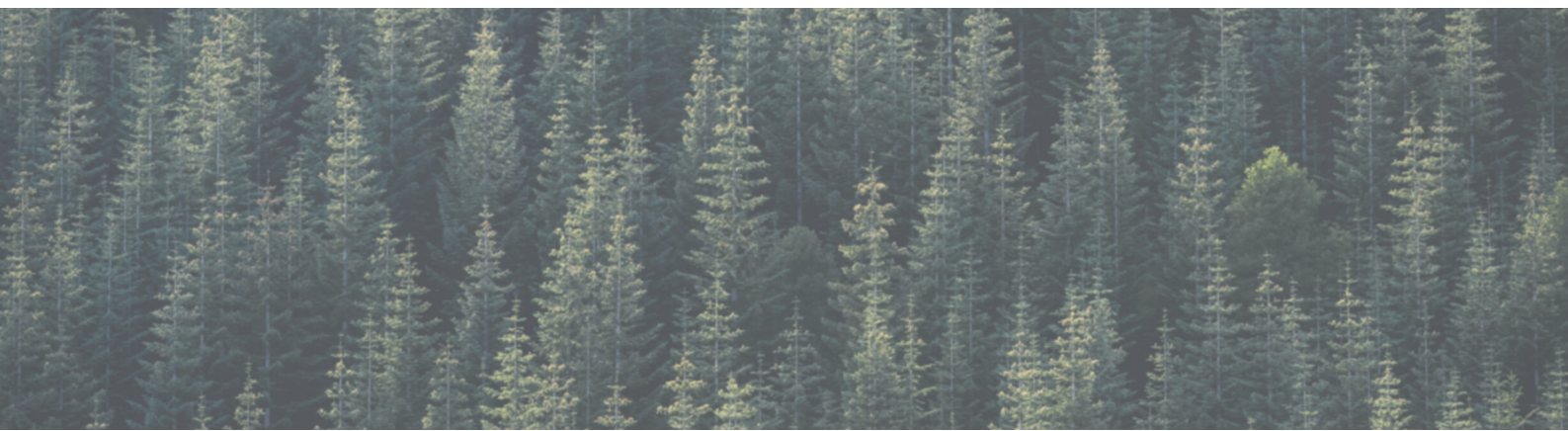
ForestQuery is on a mission to combat deforestation around the world and to raise awareness about this topic and its impact on the environment. The data analysis team at ForestQuery has obtained data from the World Bank that includes forest area and total land area by country and year from 1990 to 2016, 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 41,282,694.9 sq. km in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39,958,245.9 sq.km, a loss of 1,324,449 sq.km, or 3.20824258980244 %.

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 1,279,999.9891 sq.km).



2. REGIONAL OUTLOOK

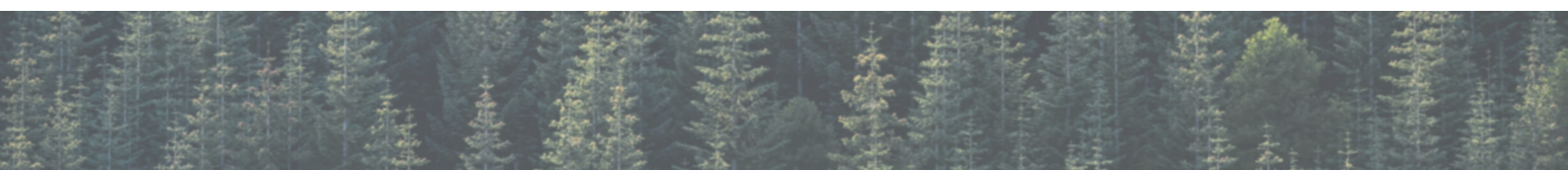
In 2016, the percent of the total land area of the world designated as forest was 31.38%. The region with the highest relative forestation was Latin America & Caribbean, with 46.14%, and the region with the lowest relative forestation was Middle East & North Africa, with 2.07% forestation.

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 51.08 %, 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
Sub-Saharan Africa	30,67	28,79
Latin America & Caribbean	51,08	46,14
World	32,42	1,04

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Latin America & Caribbean (dropped from 51.08% to 46.14%) and Sub-Sahara Africa (30.65% to 28.72%). 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 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 sqkm, much lower than the figure for China

China and United Stated 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.

3. COUNTRY-LEVEL DETAIL

A.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:

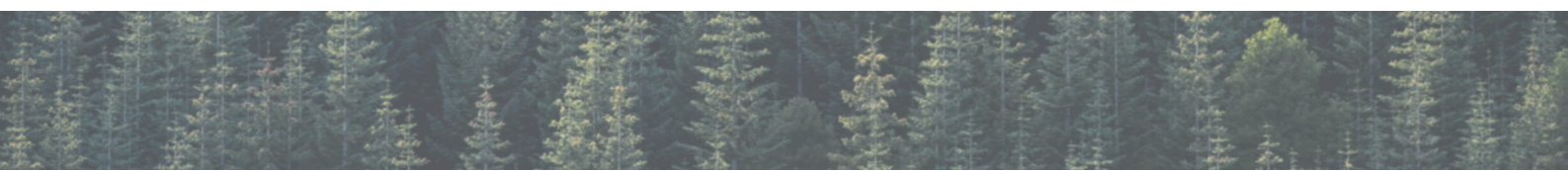


TABLE 3.1: TOP 5 AMOUNT DECREASE IN FOREST AREA BY COUNTRY, 1990 & 2016:

Country	Region	Absolute Forest Area Change
Brazil	Latin America & Caribbean	541510
Indonesia	East Asia & Pacific	282193.9844
Myanmar	East Asia & Pacific	107234.0039
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-Sahara 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
1	84
2	73
3	38
4	9

The largest number of countries in 2016 were found in the 1° quartile.
There were 85 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
Guyana	Latin America & Caribbean	83.90
Seychelles	Sub-Saharan Africa	88.41
Gabon	Sub-Saharan Africa	90.04
Suriname	Latin America & Caribbean	98.26
Lao PDR	East Asia & Pacific	82.11
Palau	East Asia & Pacific	90.98
American Samoa	East Asia & Pacific	87.50
Solomon Islands	East Asia & Pacific	77.86
Micronesia, Fed. Sts.	East Asia & Pacific	95.39

5. RECOMMENDATIONS

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

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

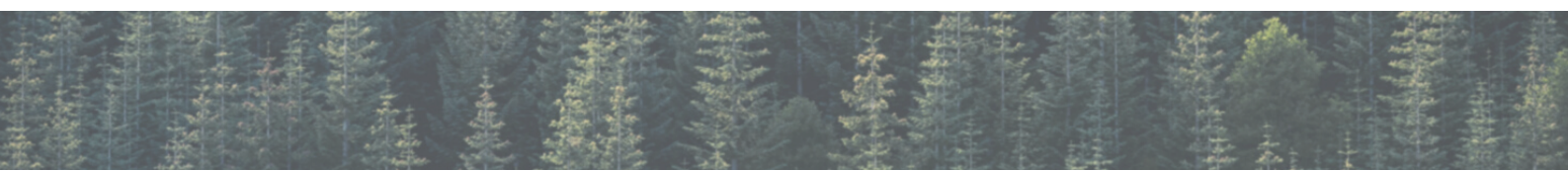
The analyzed data shows that there has been a decrease in the global forest mass between 1990 and 2016.

- The regions that have suffered the greatest decreased of forest area were Latin America & Caribbean and Sub-Sahara Africa.

-China and United States were the top two countries that had increase their forest area from 1990 to 2016 followed by small countries like Iceland.

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

We should focus in the 5 countries that saw the largest percent decrease in forest area from 1990 to 2016: Togo, Nigeria,Uganda,Mauritania and Honduras.



```
CREATE VIEW forestation
AS
SELECT f.country_code AS country_code,
f.country_name AS country_name,
f.year AS forest_year,
l.total_area_sq_mi AS forest_area_sq_mi,
f.forest_area_sqkm AS forest_area_sq_km,
r.region AS r_region,
 (f.forest_area_sqkm/(l.total_area_sq_mi*2.59))*100 AS percentage_forest_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 l.country_code=r.country_code
ORDER BY 1 DESC;
```

1.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.

41282694.9

```
SELECT SUM (f.forest_area_sqkm)
FROM forest_area f
WHERE year= 1990
AND country_name = 'World'
```

1.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.”

39958245.9

```
SELECT SUM (f.forest_area_sqkm)
FROM forest_area f
WHERE year= 2016
AND country_name = 'World'
```

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

1324449

```
SELECT(
(SELECT SUM (forest_area_sqkm)
 FROM forest_area
WHERE year=1990 AND country_name= 'World') -
(SELECT SUM (forest_area_sqkm)
FROM forest_area
WHERE year=2016 AND country_name= 'World')
 ) AS Difference
```

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

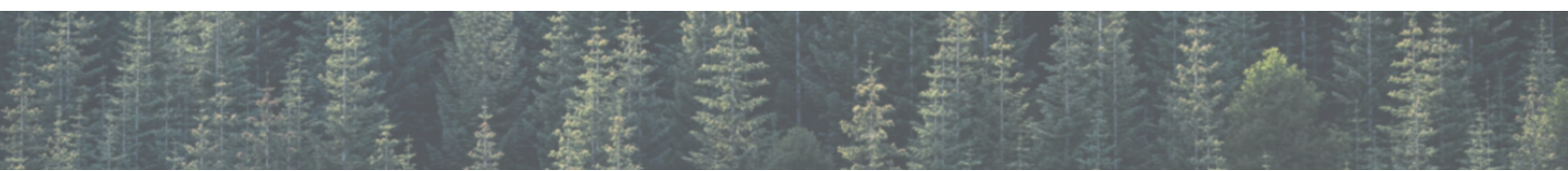
3.20824258980244 %

```
SELECT (((
(SELECT forest_area_sqkm
FROM forest_area f
WHERE country_name = 'World'
AND year=1990) - (SELECT forest_area_sqkm
FROM forest_area f
WHERE country_name = 'World'
AND year=2016)) / ((SELECT forest_area_sqkm
    FROM forest_area f
WHERE country_name = 'World'
AND year=1990))) *100) AS percentage_decrease
FROM forest_area f
LIMIT 1;
```

1E. 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?

Peru 1279999.9891 44449.0109000001

```
SELECT country_name,
2.59*(total_area_sq_mi) AS sqkm,
ABS (2.59*(total_area_sq_mi) - 1324449) AS difference
FROM land_area
ORDER BY ABS (2.59*(total_area_sq_mi) - 1324449)
LIMIT 1;
```



2. REGIONAL OUTLOOK

Create a table that shows the Regions and their percent forest area (sum of forest area divided by sum of land area) in 1990 and 2016. (Note that 1 sq mi = 2.59 sq km).

```
CREATE TABLE percent2 AS
(SELECT regions.region,
                    forest_area.year,
 ROUND(((SUM(forest_area.forest_area_sqkm) /
SUM(land_area.total_area_sq_mi*2.59))*100)::NUMERIC, 2) AS percent_forest
 FROM regions
 JOIN forest_area
 ON forest_area.country_code = regions.country_code
 JOIN land_area
 ON land_area.country_code = regions.country_code
 WHERE forest_area.year in ('1990','2016')
 GROUP BY regions.region, forest_area.year
)
```

2a. What was the percent forest of the entire world in 2016?
31.38

```
SELECT * FROM percent2
WHERE year = '2016'
AND region = 'World'
ORDER BY percent_forest
```

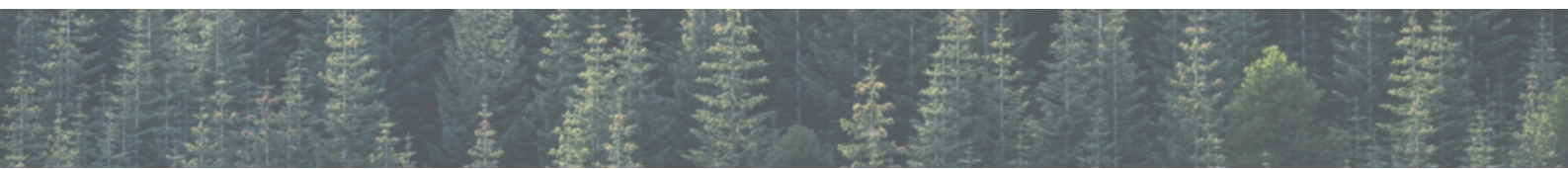
Which region had the HIGHEST percent forest in 2016, and which had the LOWEST, to 2 decimal places?

Lowest: Middle East & North Africa 2016 2.07

```
SELECT * FROM percent2
WHERE year = '2016'
ORDER BY percent_forest
LIMIT 1;
```

Highest: Latin America & Caribbean 2016 46.14

```
SELECT * FROM percent2
WHERE year = '2016'
ORDER BY percent_forest desc
LIMIT 1;
```



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

World 1990 32.42

```
SELECT * FROM percent2
WHERE year = '1990'
AND region = 'World'
ORDER BY percent_forest
```

Which region had the HIGHEST percent forest in 1990?

Middle East & North Africa 1990 1.78

```
SELECT * FROM percent2
WHERE year = '1990'
ORDER BY percent_forest
LIMIT 1
```

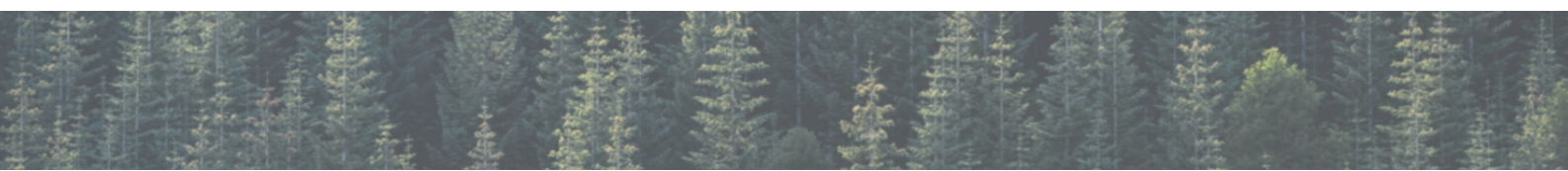
Which had the LOWEST, to 2 decimal places?

Latin America & Caribbean 1990 51.08

```
SELECT * FROM percent2
WHERE year = '1990'
ORDER BY percent_forest desc
LIMIT 1
```

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

```
SELECT a.region,
                a.percent_forest as pf_1990,
b.percent_forest as pf_2016,
        (a.percent_forest - b.percent_forest) as difference
FROM percent2 a
JOIN percent2 b
         ON a.region = b.region
WHERE a.year = 1990 and b.year = 2016 and
(a.percent_forest - b.percent_forest)> 0
```



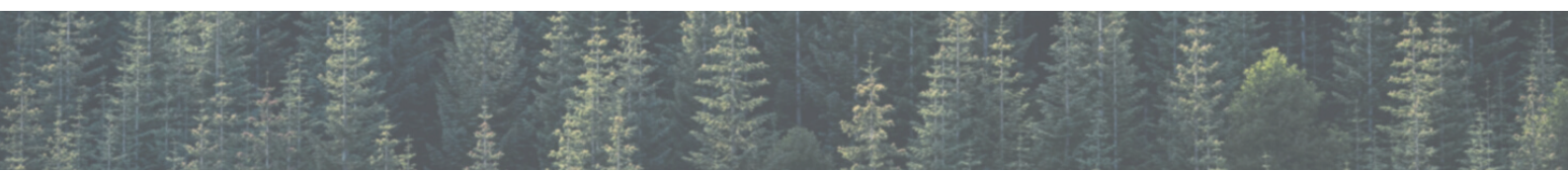
3. COUNTRY-LEVEL DETAIL

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?

```
SELECT a.country_name,
                c.region,
                a.forest_area_sqkm as fa_1990,
                b.forest_area_sqkm as fa_2016,
        (a.forest_area_sqkm - b.forest_area_sqkm) AS difference
FROM forest_area a
JOIN forest_area b
         ON a.country_name = b.country_name
JOIN regions c
         ON a.country_name = c.country_name
WHERE a.year = 1990 AND b.year = 2016 AND a.forest_area_sqkm is not null and b.forest_area_sqkm IS
NOT NULL
ORDER BY difference desc
 LIMIT 6;
```

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?

```
SELECT a.country_name,
                c.region,
                a.forest_area_sqkm as fa_1990,
                b.forest_area_sqkm as fa_2016,
        ROUND(((a.forest_area_sqkm - b.forest_area_sqkm)*100/a.forest_area_sqkm)::NUMERIC, 2) AS
percent
FROM forest_area a
JOIN forest_area b
         ON a.country_name = b.country_name
JOIN regions c
         ON a.country_name = c.country_name
WHERE a.year = 1990 and b.year = 2016 AND a.forest_area_sqkm IS NOT NULL AND
b.forest_area_sqkm IS NOT NULL
ORDER BY percent DESC
 LIMIT 5;
```



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

```
CREATE TABLE percent3 AS
(SELECT regions.region,
   forest_area.country_name,
   forest_area.year,
ROUND(((SUM(forest_area.forest_area_sqkm)                                                    /
SUM(land_area.total_area_sq_mi*2.59))*100)::NUMERIC, 2) AS percent_forest
 FROM regions
 JOIN forest_area
 ON forest_area.country_code = regions.country_code
 JOIN land_area
 ON land_area.country_code = regions.country_code
 GROUP BY regions.region, forest_area.country_name, forest_area.year

CREATE TABLE quartile AS (
SELECT country_name,
   percent_forest,
   CASE
   WHEN percent_forest < 25
   THEN 'Q1'
   WHEN percent_forest > 25 AND percent_forest < 50
   THEN 'Q2'
   WHEN percent_forest > 50 AND percent_forest < 75
   THEN 'Q3'
   ELSE 'Q4'
   END AS Quartile
FROM percent3
WHERE percent_forest IS NOT NULL AND year = 2016 AND country_name != 'World')


SELECT Quartile, COUNT(*) FROM quartile GROUP BY Quartile
ORDER BY quartile
```

d. List all of the countries that were in the 4th quartile (percent forest > 75%) in 2016.

```
SELECT *
FROM percent3
WHERE percent_forest > 75 AND percent_forest < 100 AND year = 2016
```

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

```
SELECT COUNT(*)
FROM percent3
WHERE percent_forest > (SELECT percent_forest from percent3 WHERE country_name = 'United States'
AND year = 2016)
 AND year = 2016
```