

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 km² in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39958245.9 km², a loss of 1324449 km², 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 km²).

2. REGIONAL OUTLOOK

In 2016, the percent of the total land area of the world designated as forest was 31.37%. 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.

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

Region	1990 Forest Percentage	2016 Forest Percentage
Latin America & Caribbean	51.03	46.16
Sub-Saharan Africa	30.67	28.79
Europe & Central Asia	37.28	38.04
East Asia & Pacific	25.78	26.36

South Asia	16.51	17.51
Middle East & North Africa	1.78	2.07
North America	35.65	36.04

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 31.37%.

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 km². 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 km², 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 km ²
Indonesia	East Asia & Pacific	282193.98 km ²
Myanmar	East Asia & Pacific	107234.00 km ²

Nigeria	Sub-Saharan Africa	106506.00 km ²
Tanzania	Sub-Saharan Africa	102320 km ²

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
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	East Asia & Pacific	82.11
Solomon Islands	East Asia & Pacific	77.87

5. RECOMMENDATIONS

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

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

In this report, I have analyzed the deforestation using the World Bank Data. Database is divided into three main tables, 1) Forest_area, 2) Land_area, and 3) Regions

Forest_area
Country_code
Country_name [PK]
Year
Forest_area_sqkm

Land_area
Country_code
Country_name [PK]
Year
total_area_sq_mi

Regions
Country_name [PK]
Country_code
Region
Income_group

In which Country_name or country_code can be used as Primary key with the total country 219 included in 8 regions of the World. I have further split data into temporary tables according to the year = 1990 and 2016.

- Which countries should we focus on over others?

My analysis shows the total land area of the World designated as forest has been decrease to about 1% from 1990 to 2016. In which the most deforestation regions are Latin America & Caribbean (especially the Honduras Country) and Sub-Saharan Africa (mainly Togo, Nigeria, Uganda, Mauritania countries).

Appendix:

Creating View named forestation that compiles all the columns of forest area, land area, and regions.

```
CREATE view forestation AS
SELECT la.country_name, la.country_code, la.year, r.income_group, r.region, fa.forest_area_sqkm,
la.total_area_sq_mi*2.59 AS total_area_sqkm, (fa.forest_area_sqkm*100)/(la.total_area_sq_mi*2.59) AS
percent_land_area_designed_as_forest
FROM forest_area AS fa
JOIN land_area AS la on fa.country_code = la.country_code and fa.year = la.year
JOIN regions AS r on fa.country_code = r.country_code
```

Now print 5 rows of forestation having highest percent land area designed as forest, using command

```
SELECT *
FROM forestation
where percent_land_area_designed_as_forest is not null
order by percent_land_area_designed_as_forest DESC
limit 5;
```

country_name	country_code	year	income_group	region	forest_area_sqkm	total_area_sqkm	percent_land_area_designated_as_forest
Suriname	SUR	1990	Upper middle income	Latin America & Caribbean	154300	155999.9994	98.91025679
Suriname	SUR	1991	Upper middle income	Latin America & Caribbean	154260.9961	155999.9994	98.88525429
Suriname	SUR	1992	Upper middle income	Latin America & Caribbean	154222.002	155999.9994	98.86025807
Suriname	SUR	1993	Upper middle income	Latin America & Caribbean	154182.998	155999.9994	98.83525551
Suriname	SUR	1994	Upper middle income	Latin America & Caribbean	154144.0039	155999.9994	98.81025929

Global Situation

Total forest area of World in 1990:

```
select forest_area_sqkm from forestation
where country_name = 'World' and year = 1990
```

Total forest area of World in 2016:

```
select forest_area_sqkm from forestation
where country_name = 'World' and year = 2016
```

Difference in forest area:

```
select
(select sum(forest_area_sqkm) from forestation where year = 1990 and country_name = 'World')
-
(select sum(forest_area_sqkm) from forestation where year = 2016 and country_name = 'World')
```

as difference

Percentage in forest area:

```
SELECT
(((SELECT SUM(forest_area_sqkm) FROM forestation WHERE year = 1990 AND
country_name = 'World')
```

-

```
(SELECT SUM(forest_area_sqkm) FROM forestation WHERE year = 2016 AND country_name = 'World'))*100)/ (SELECT SUM(forest_area_sqkm) FROM forestation WHERE year = 1990 AND country_name = 'World')
```

as percentage

Land Area slightly lower than the amount of World forest area lost from 1990 to 2016

```
select country_name, total_area_sqkm from forestation
where year =2016 and total_area_sqkm < (
  select
    (select sum(forest_area_sqkm) from forestation where year = 1990 and country_name = 'World')
    -
    (select sum(forest_area_sqkm) from forestation where year = 2016 and country_name = 'World')
  as difference)

order by total_area_sqkm DESC
limit 1;
```

Regional Outlook

Percent of total land area of world designated as forest in 1990 and 2016

```
select country_name, region, percent_land_area_designed_as_forest
from forestation
where country_name = 'World' and (year = 2016 or year = 1990)
```

Highest/lowest relative region of forestation in 1990 and 2016

```
SELECT region, (SUM(forest_area_sqkm)/SUM(total_area_sqkm))*100
FROM forestation
WHERE year = 1990
AND
country_name!='World'
GROUP BY region
```

Same above command applies for year =2016

Country Level Detail

To evaluate data between two years (ie 1990 and 2016). I have created view named as forestation_1990 and forestation_2016 having all columns from forestation

```
create view forestation_2016 as
select * from forestation
where year = 2016;
```

```
create view forestation_1990 as
select * from forestation
where year =1990;
```

3A:

```
SELECT f16.country_name, ABS(f90.forest_area_sqkm - f16.forest_area_sqkm) AS
change_in_forest_area
FROM forestation_1990 AS f90
JOIN forestation_2016 AS f16 ON f90.country_name = f16.country_name
WHERE (f90.forest_area_sqkm-f16.forest_area_sqkm) IS NOT NULL
AND
(f90.forest_area_sqkm-f16.forest_area_sqkm) < 0
ORDER BY ABS(f90.forest_area_sqkm - f16.forest_area_sqkm) DESC
LIMIT 2;
```

Largest increase in percent forest area from 1990 to 2016

```
SELECT f16.country_name, ABS((f90.forest_area_sqkm-
f16.forest_area_sqkm)*100)/f90.forest_area_sqkm AS change_in_percent_forest_area

FROM forestation_1990 AS f90
JOIN forestation_2016 AS f16 on f90.country_name = f16.country_name
WHERE ((f90.forest_area_sqkm-f16.forest_area_sqkm)*100)/f90.forest_area_sqkm IS NOT
NULL
AND
((f90.forest_area_sqkm-f16.forest_area_sqkm)*100)/f90.forest_area_sqkm < 0

ORDER BY ((f90.forest_area_sqkm-f16.forest_area_sqkm)*100)/f90.forest_area_sqkm ASC
LIMIT 1;
```


3B:

Table 3.1

```
SELECT f16.country_name, f16.region, ABS(f90.forest_area_sqkm - f16.forest_area_sqkm) AS  
decrease_in_forest_area_sqkm  
FROM forestation_1990 AS f90  
JOIN forestation_2016 AS f16 on f90.country_name = f16.country_name  
WHERE (f90.forest_area_sqkm-f16.forest_area_sqkm) IS NOT NULL  
AND  
(f90.forest_area_sqkm-f16.forest_area_sqkm) > 0  
AND  
f16.region != 'World'  
ORDER BY ABS(f90.forest_area_sqkm - f16.forest_area_sqkm) DESC  
LIMIT 5;
```

Table3.2

```
SELECT f16.country_name, ABS((((f90.forest_area_sqkm-  
f16.forest_area_sqkm)*100)/(f90.forest_area_sqkm)) AS change_in_forest_area  
  
FROM forestation_1990 as f90  
JOIN forestation_2016 as f16 on f90.country_name = f16.country_name  
WHERE (((f90.forest_area_sqkm-f16.forest_area_sqkm)*100)/(f90.forest_area_sqkm)) IS NOT  
NULL  
AND  
((((f90.forest_area_sqkm-f16.forest_area_sqkm)*100)/(f90.forest_area_sqkm)) > 0  
  
ORDER BY change_in_forest_area DESC  
LIMIT 5;
```

3C:

Table 3.3

```
select  
case  
  when percent_land_area_designed_as_forest between 0 and 25 then '0-25'  
  when percent_land_area_designed_as_forest between 25 and 50 then '25-50'  
  when percent_land_area_designed_as_forest between 50 and 75 then '50-75'  
  when percent_land_area_designed_as_forest between 75 and 100 then '75-100'  
end as Range,  
count(country_name) as Count  
from forestation  
where year = 2016 and percent_land_area_designed_as_forest is not null  
and country_name != 'World'  
group by Range
```

order by count DESC

Table 3.4

```
SELECT country_name, region, CAST(percent_land_area_designed_as_forest as
decimal(16,2)),count(country_name) OVER(PARTITION BY
percent_land_area_designed_as_forest>75 and percent_land_area_designed_as_forest<100)
AS total_country_count from forestation_2016
WHERE country_name!='World' and percent_land_area_designed_as_forest IS NOT NULL
AND
percent_land_area_designed_as_forest > 75
ORDER BY percent_land_area_designed_as_forest DESC
```