

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 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 3.20 %.

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 31.37. 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 2.06% 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 51.02%, and the region with the lowest relative forestation was Middle East & North Africa, with 1.77% forestation.

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

Region	1990 Forest Percentage	2016 Forest Percentage
Latin America & Caribbean	51.0299798667514	46.1620721996047
Sub-Saharan Africa	30.6741454610006	28.7881883550464
World	32.4222035575689	31.3755709643095

The only regions of the world that decreased in percent forest area from 1990 to 2016 were **Latin America & Caribbean** (dropped from **51.02 % to 46.17%**) and **Sub-Saharan Africa** (**30.67% to 28.78%**). All other regions increased in forest area over this time period. However, the drop in forest area in the two regions was so large, the percent forest area of the world decreased over this time period from **32.43 % 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 **527,229.062 sq km**. 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 **USA**, but it only saw an increase of **79,200** sq km, much lower than the figure for CHINA.

CHINA and USA 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	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 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.

C. QUARTILES

Table 3.3: 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 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
American Samoa	East Asia & Pacific	87.50
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Gabon	Sub-Saharan Africa	90.04
Guyana	Latin America & Caribbean	83.90
Lao PDR	East Asia & Pacific	82.11
Palau	East Asia & Pacific	87.61
Solomon Islands	East Asia & Pacific	77.86
Suriname	Latin America & Caribbean	98.26
Seychelles	Sub-Saharan Africa	88.41

4. RECOMMENDATIONS

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

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

We have learned that the world forest area reduced by 3.2% in about 26 years. It is a significant change. Latin America & Caribbean and Sub-Saharan Africa need to be studied to see why they are the only regions with decrease in forest area. The latter being the most affected region with over 4 countries out of top 5 lying in it.

Countries like China, USA and Iceland need to be studied as well to understand how they managed to increase the forest areas.

- *Which countries should we focus on over others?*
 - Nigeria, because it is amongst the worst affected both area and percentage wise.
 - Countries that are among the top 5 regions that saw biggest area reductions like Brazil and Indonesia.
 - Countries like China and USA that can showcase how they managed to increase their forest areas significantly.

5. APPENDIX: SQL Queries Used

Create VIEW forestation

as

```
SELECT fa.country_code as country_code,
       fa.country_name as country_name,
       fa.year as year,
       fa.forest_area_sqkm as forest_area_sqkm,
       la.total_area_sq_mi as total_area_sq_mi,
       r.region as region,
       r.income_group as income_group,
       (forest_area_sqkm/(total_area_sq_mi*2.59))*100 as percent_forest_area
FROM forest_area fa
JOIN land_area la
ON fa.country_code=la.country_code
AND fa.year = la.year
JOIN regions r
ON la.country_code=r.country_code
ORDER BY 1;
```

1. 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
```

41282694.9

2. 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

3. 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 as fa
FROM forestation
WHERE region = 'World' AND year = 1990),
t2 as
```

```
(SELECT region, forest_area_sqkm as fa
FROM forestation
WHERE region = 'World' AND year = 2016)
```

```
SELECT t1.fa-t2.fa as change_sqkm
FROM t1
JOIN t2
ON t1.region=t2.region
```

1324449

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

```
WITH t1 as
(SELECT region, forest_area_sqkm as fa
FROM forestation
WHERE region = 'World' AND year = 1990),

t2 as
(SELECT region, forest_area_sqkm as fa
FROM forestation
WHERE region = 'World' AND year = 2016)

SELECT (t1.fa-t2.fa)/t1.fa * 100 as change_percent
FROM t1
JOIN t2
ON t1.region=t2.region
```

3.20824258980244

5. 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?

```
SELECT f.country_code cc, f.country_name country, f.total_area_sq_mi*2.59 as total_area
FROM forestation f
WHERE (f.total_area_sq_mi*2.59) >= (WITH t1 as
(SELECT region, forest_area_sqkm as fa
FROM forestation
WHERE region = 'World' AND year = 1990),

t2 as
(SELECT region, forest_area_sqkm as fa
FROM forestation
```

```
WHERE region = 'World' AND year = 2016)
```

```
SELECT t1.fa-t2.fa as change_sqkm  
FROM t1  
JOIN t2  
ON t1.region=t2.region)  
  
ORDER BY 3  
LIMIT 1
```

MANGOLIA

```
SELECT f.country_code cc, f.country_name country, f.total_area_sq_mi*2.59 as total_area  
FROM forestation f  
WHERE (f.total_area_sq_mi*2.59) < (WITH t1 as  
(SELECT region, forest_area_sqkm as fa  
FROM forestation  
WHERE region = 'World' AND year = 1990),  
  
t2 as  
(SELECT region, forest_area_sqkm as fa  
FROM forestation  
WHERE region = 'World' AND year = 2016)  
  
SELECT t1.fa-t2.fa as change_sqkm  
FROM t1  
JOIN t2  
ON t1.region=t2.region)  
  
ORDER BY 3 DESC  
LIMIT 1      -
```

PERU

**A- 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).
Based on the table you created,**


```
CREATE OR REPLACE VIEW region_forest
as
Select region,year,
SUM(forest_area_sqkm) total_region_forest,
SUM(total_area_sq_mi)*2.59 total_region_land,
100*SUM(forest_area_sqkm)/(SUM(total_area_sq_mi)*2.59) as percent_forest
From forestation
Group by 1,2
Order by 1,2;
```

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?

WORLD:

```
Select region, percent_forest
FROM region_forest
WHERE year= 2016 AND region = 'World'
```

```
region percent_forest
World      31.3755709643095
```

HIGHEST :

```
Select region, percent_forest
FROM region_forest
WHERE year= 2016
Order By 2 Desc
Limit 1
```

```
region          percent_forest
Latin America & Caribbean  46.1620721996047
```

LOWEST:

```
Select region, percent_forest
FROM region_forest
WHERE year= 2016
Order By 2
Limit 1
```

```
region          percent_forest
Middle East & North Africa  2.06826486871501
```

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?

WORLD)

```
Select region, percent_forest
FROM region_forest
WHERE year= 1990 AND region = 'World'
```

region	percent_forest
World	32.4222035575689

HIGHEST)

```
Select region, percent_forest
FROM region_forest
WHERE year= 1990
Order By 2 Desc
Limit 1
```

region	percent_forest
Latin America & Caribbean	51.0299798667514

LOWEST

```
Select region, percent_forest
FROM region_forest
WHERE year= 1990
Order By 2
Limit 1
```

region	percent_forest
Middle East & North Africa	1.77524062469353

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

```
With t1 as
(Select *
FROM region_forest
WHERE year = 1990) ,

t2
as
(Select *
FROM region_forest
WHERE year = 2016)

SELECT t1.region, t1.percent_forest forest_1990, t2.percent_forest forest_2016
FROM t1
JOIN t2
ON t1.region = t2.region
WHERE t1.percent_forest>t2.percent_forest
```

region	forest_1990	forest_2016
Latin America & Caribbean	51.0299798667514	46.1620721996047
Sub-Saharan Africa	30.6741454610006	28.7881883550464
World	32.4222035575689	31.3755709643095

PART 3

3. COUNTRY-LEVEL DETAIL

Instructions:

Answering these questions will help you add information to the template.

Use these questions as guides to write SQL queries.

Use the output from the query to answer these questions.

Country with largest increase in forest area

-ABSOLUTE INCREASE COUNTRYWISE

```
WITH t1 as
(SELECT country_code, country_name, forest_area_sqkm
FROM forestation
WHERE year= 1990 AND forest_area_sqkm IS NOT NULL AND country_name != 'World') ,

t2 as
(SELECT country_code, country_name, forest_area_sqkm
FROM forestation
WHERE year= 2016 AND forest_area_sqkm IS NOT NULL AND country_name != 'World')

SELECT t2.country_code, t2.country_name, (t2.forest_area_sqkm - t1.forest_area_sqkm) as
change_forest_area
FROM t1
JOIN t2
ON t1.country_code = t2.country_code
ORDER BY 3 DESC
LIMIT 5
```

country_code	country_name	change_forest_area
CHN	China	527229.062

PERCENTAGE – LARGEST COUNTRYWISE INCREASE

```
WITH t1 as
(SELECT country_code, country_name, forest_area_sqkm
FROM forestation
WHERE year= 1990 AND forest_area_sqkm IS NOT NULL AND country_name != 'World') ,

t2 as
(SELECT country_code, country_name, forest_area_sqkm
FROM forestation
WHERE year= 2016 AND forest_area_sqkm IS NOT NULL AND country_name != 'World')

SELECT t1.country_code, t1.country_name, ROUND(CAST(((t2.forest_area_sqkm -
t1.forest_area_sqkm)*100/t1.forest_area_sqkm) AS Numeric),2) as
percent_change_forest_area
FROM t1
```

```

JOIN t2
ON t1.country_code = t2.country_code
ORDER BY 3 DESC
LIMIT 5

```

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?

```

WITH t1 as
(SELECT country_code, region, country_name, forest_area_sqkm
FROM forestation
WHERE year= 1990 AND forest_area_sqkm IS NOT NULL AND country_name != 'World') ,

t2 as
(SELECT country_code, region, country_name, forest_area_sqkm
FROM forestation
WHERE year= 2016 AND forest_area_sqkm IS NOT NULL AND country_name != 'World')

SELECT t1.country_code, t1.country_name, t1.region, (t1.forest_area_sqkm -
t2.forest_area_sqkm) as change_forest_area
FROM t1
JOIN t2
ON t1.country_code = t2.country_code
ORDER BY 4 DESC
LIMIT 5

```

country_code	country_name	change_forest_area
BRA	Brazil	541510
IDN	Indonesia	282193.9844
MMR	Myanmar	107234.0039
NGA	Nigeria	106506.00098
TZA	Tanzania	102320

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 country_code, region, country_name, forest_area_sqkm
FROM forestation
WHERE year= 1990 AND forest_area_sqkm IS NOT NULL AND country_name != 'World') ,

```

```

t2 as
(SELECT country_code, region, country_name, forest_area_sqkm
FROM forestation
WHERE year= 2016 AND forest_area_sqkm IS NOT NULL AND country_name != 'World')

SELECT t1.country_code, t1.country_name, t1.region, ROUND(CAST(((t1.forest_area_sqkm -
t2.forest_area_sqkm)*100/t1.forest_area_sqkm) AS Numeric),2) as
percent_change_forest_area
FROM t1
JOIN t2
ON t1.country_code = t2.country_code
ORDER BY 4 DESC
LIMIT 5

```

country_code	country_name	percent_change_forest_area
TGO	Togo	75.45
NGA	Nigeria	61.80
UGA	Uganda	59.13
MRT	Mauritania	46.75
HND	Honduras	45.03

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

```

WITH t1 as
(SELECT country_code, country_name,
Round(cast(forest_area_sqkm*100/(total_area_sq_mi*2.59) as numeric),2) as percent_forest
FROM forestation
WHERE year = 2016 AND forest_area_sqkm IS NOT NULL AND total_area_sq_mi IS NOT
NULL AND country_name != 'World'
ORDER BY 3),

t2 as

(SELECT country_code, country_name, percent_forest, CASE WHEN t1.percent_forest >= 75
THEN 4 WHEN t1.percent_forest BETWEEN 50 AND 75 THEN 3 WHEN t1.percent_forest
BETWEEN 25 AND 50 THEN 2 ELSE 1 END AS quartile
FROM t1
ORDER BY 3)

SELECT quartile, COUNT(*)
FROM t2

```

GROUP BY 1
ORDER BY 2 DESC

quartile	count
1	85
2	72
3	38
4	9

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

```
WITH t1 as
(SELECT country_code, region, country_name,
Round(cast(forest_area_sqkm*100/(total_area_sq_mi*2.59) as numeric),2) as percent_forest
FROM forestation
WHERE year = 2016 AND forest_area_sqkm IS NOT NULL AND total_area_sq_mi IS NOT
NULL AND country_name != 'World'
ORDER BY 3),
```

t2 as

```
(SELECT country_code, country_name, region, percent_forest, CASE WHEN t1.percent_forest
>= 75 THEN 4 WHEN t1.percent_forest BETWEEN 50 AND 75 THEN 3 WHEN
t1.percent_forest BETWEEN 25 AND 50 THEN 2 ELSE 1 END AS quartile
FROM t1
ORDER BY 3)
```

```
SELECT country_code, country_name, region, percent_forest
FROM t2
WHERE quartile = 4
ORDER BY 1
```

country_code	country_name	percent_forest
ASM	American Samoa	87.50
FSM	Micronesia, Fed. Sts.	91.86
GAB	Gabon	90.04
GUY	Guyana	83.90
LAO	Lao PDR	82.11
PLW	Palau	87.61
SLB	Solomon Islands	77.86
SUR	Suriname	98.26
SYC	Seychelles	88.41

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

```
WITH t1 as
(SELECT country_code, country_name,
Round(cast(forest_area_sqkm*100/(total_area_sq_mi*2.59) as numeric),2) as percent_forest
FROM forestation
WHERE year = 2016 AND country_name = 'United States')

SELECT COUNT(*)
FROM
(SELECT country_code, country_name,
Round(cast(forest_area_sqkm*100/(total_area_sq_mi*2.59) as numeric),2) as percent_forest
FROM forestation
WHERE YEAR = 2016 AND Round(cast(forest_area_sqkm*100/(total_area_sq_mi*2.59) as
numeric),2) > (Select percent_forest FROM (SELECT country_code, country_name,
Round(cast(forest_area_sqkm*100/(total_area_sq_mi*2.59) as numeric),2) as percent_forest
FROM forestation
WHERE year = 2016 AND country_name = 'United States') t2))t3
```

count

94