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 km2 in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39,958,245.9km2, a loss of 1,324,449km2 , or 3.2%.

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 1,279,999.99km2)

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 and the Caribbean, with 46.16%, and the region with the lowest relative forestation was Middle East and 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 and the 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
Europe & Central Asia	37.28	38.04
North America	35.65	36.04
World	32.42	31.38
Sub-Saharan Africa	30.67	28.79
East Asia & Pacific	25.78	26.36
South Asia	16.51	17.51
Middle East & North Africa	1.78	2.07
World	32.42	31.38

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 527229.06km2. 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, much lower than the figure for China.

China and the 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 68.12% 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(km2)
Brazil	Latin America & Caribbean	541,510
Indonesia	East Asia & Pacific	282,193.98
Myanmar	East Asia & Pacific	107,234
Nigeria	Sub-Saharan Africa	106,506
Tanzania	Sub-Saharan Africa	102,320

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	Percent Forest Area Change(%)
Togo	Sub-Saharan Africa	75.45
Nigeria	Sub-Saharan Africa	61.8

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:

Number of Countries	Quartiles
85	Q1- Number of countries with percent forestation under 25%
72	Q2 Number of countries with percent forestation between 25% and 50%
38	Q3 Number of countries with percent forestation between 50% and 75%
9	Q4 Number of countries with percent forestation over 75%

The largest number of countries in 2016 were found in the first quartile or bottom (Q1).

There were 9 countries in the top quartile(Q4) 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	Percent 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	87.5
Guyana	Latin America & Caribbean	83.9
Lao PDR	East Asia & Pacific	82.11
Solomon Islands	East Asia & Pacific	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?*
- *Which countries should we focus on over others?*

From this study, I have learned that many regions in the world are losing their forest area. The loss in forest area is having a significant impact as the consistent decrease in forest area without proportional reforestation is depleting the habitat. We could see the specific regions of interest is Sub-Saharan Africa where a combined forest area loss is quite alarming. However, on a closer study, we see that Brazil has the highest loss of forest area during the years under study. Furthermore, we see that 2 countries in the Sub-Saharan African region still made it to this list.

Also interesting to note that while deforestation is eating deep into our habitat, some countries like China and USA are in fact increasing their forest area irrespective of their large total land area compared to the other countries in the world. It is also interesting to see that significantly smaller countries like Iceland and French Polynesia are significantly increasing their forest area and not the reverse.

We should focus on countries like China, the USA, and Iceland so as to learn what they are doing right and try to draw insights from them and then recommend these to countries in the Sub-Saharan region to help combat this trend of forest area loss.

In conclusion, about 72 countries (on average) have recorded a change in their forest area in the years under study. This shows that indeed deforestation is a growing concern and should receive more attention.

5. APPENDIX: SQL Queries Used

```
------CREATES VIEW WITH EXTRA COLUMN ROUND AND CAST---
DROP VIEW IF EXISTS forestation;
CREATE VIEW forestation
AS
(SELECT f.country_code country_forest_code,f.country_name
country_name,r.region region_name,r.income_group
region_income_group,f.year country_forest_year,f.forest_area_sqkm
forest_area_sqkm,
       (l.total_area_sq_mi
*2.59)land_total_area_sqkm,ROUND(CAST(((SUM(f.forest_area_sqkm)/SUM(l.tota
l_area_sq_mi *2.59)*100))AS NUMERIC),2)percent_forest

FROM   forest_area f
JOIN   land_area  l
ON     f.country_code=l.country_code AND f.year=l.year
JOIN   regions r
ON     r.country_code=l.country_code
GROUP BY 1,2,3,4,5,6,7)
ORDER BY 1;
SELECT *
FROM forestation;
-------What was the total forest area (in sq km) of the world in 1990?---
41,282,694.9---
SELECT forest_area_sqkm world_forest_area_1990
```

```
FROM   forestation
WHERE  country_name='World' AND country_forest_year=1990;

---percent change in world forest area 1990/2016---
SELECT forest_area_sqkm world_forest_area_1990,percent_forest
percent_forest_area_world_1990
FROM   forestation
WHERE  country_name='World' AND country_forest_year=1990;

SELECT forest_area_sqkm world_forest_area_1990,percent_forest
percent_forest_area_world_2016
FROM   forestation
WHERE  country_name='World' AND country_forest_year=2016;

-----What was the total forest area (in sq km) of the world in 2016?----
39,958,245.9
SELECT forest_area_sqkm world_forest_area_2016
FROM   forestation
WHERE  country_name='World' AND country_forest_year=2016;

----What was the change (in sq km) in the forest area of the world from
1990 to 2016?---1,324,449

SELECT
        (SELECT forest_area_sqkm world_forest_area_1990
         FROM   forestation
         WHERE  country_name='World' AND country_forest_year=1990)-
        (SELECT forest_area_sqkm world_forest_area_2016
         FROM   forestation
         WHERE  country_name='World' AND
country_forest_year=2016)forest_area_change_1990_2016
FROM forestation;

-----What was the percent change in forest area of the world between 1990
and 2016?-----3.20824258980244

SELECT ((OLD -NEW)/OLD *100)
FROM   forestation


SELECT
```

```
((((SELECT forest_area_sqkm world_forest_area_1990
FROM forestation
WHERE country_name='World'
AND country_forest_year=1990)-(SELECT forest_area_sqkm
world_forest_area_1990
FROM forestation
WHERE country_name='World'
AND country_forest_year=2016))/(SELECT forest_area_sqkm
world_forest_area_1990
FROM forestation
WHERE country_name='World'
AND country_forest_year=1990))*100)percent_forest_area_change_1990_2016

------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
1,279,999.9891

SELECT country_name,land_total_area_sqkm
FROM forestation

WHERE land_total_area_sqkm <=
        (SELECT ROUND(CAST(forest_area_sqkm AS numeric), 2)
world_forest_area_1990
         FROM   forestation
         WHERE  country_name='World' AND country_forest_year=1990)-
        (SELECT forest_area_sqkm world_forest_area_2016
         FROM   forestation
         WHERE  country_name='World' AND country_forest_year=2016)
AND country_forest_year=2016
ORDER BY land_total_area_sqkm DESC
LIMIT 1;
----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.
---table called result 5 csv

WITH t1 AS

(SELECT region_name
name_of_region1,ROUND(CAST((SUM(forest_area_sqkm)/SUM(land_total_area_sqkm
))*100 AS NUMERIC),2) region_percent_1990
```

```
FROM forestation
where country_forest_year =1990
group by 1
ORDER BY region_percent_1990 desc),

t2 AS
(SELECT region_name
name_of_region2,ROUND(CAST((SUM(forest_area_sqkm)/SUM(land_total_area_sqkm
))*100 AS NUMERIC),2) region_percent_2016
FROM forestation
where country_forest_year =2016
group by 1
ORDER BY region_percent_2016 desc)

SELECT name_of_region1,region_percent_1990,region_percent_2016
FROM t1
JOIN t2
ON t1.name_of_region1=t2.name_of_region2

-----Which 5 countries saw the largest amount decrease in forest area from
1990 to 2016? What was the
---difference in forest area for each?-- result7 csv




WITH
t4 AS
(SELECT country_name country_1990, region_name
name_of_region4,forest_area_sqkm forest_area_1990
FROM forestation
WHERE country_forest_year=1990 AND forest_area_sqkm IS NOT NULL AND
country_name <>'World'),

t5 AS
(SELECT country_name country_2016, region_name
name_of_region5,forest_area_sqkm forest_area_2016
FROM forestation
```

```
WHERE country_forest_year=2016 AND forest_area_sqkm IS NOT NULL AND
country_name <>'World')

SELECT country_2016,name_of_region5, (forest_area_1990- forest_area_2016)
forest_area_decrease
FROM   t4
JOIN   t5
ON    t4.country_1990=t5.country_2016 AND
t4.name_of_region4=t5.name_of_region5

ORDER BY forest_area_decrease DESC
LIMIT 5;

-----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?--
result8.csv---

WITH
t4 AS
(SELECT country_name country_1990, region_name
name_of_region4,forest_area_sqkm forest_area_1990
FROM forestation
WHERE country_forest_year=1990 AND forest_area_sqkm IS NOT NULL AND
country_name <>'World'),
t5 AS
(SELECT country_name country_2016, region_name
name_of_region5,forest_area_sqkm forest_area_2016
FROM forestation
WHERE country_forest_year=2016 AND forest_area_sqkm IS NOT NULL AND
country_name <>'World')

SELECT country_2016,name_of_region5, ROUND(CAST(((forest_area_1990-
forest_area_2016)/(forest_area_1990))*100 AS NUMERIC),2)
percent_forest_area_decrease
FROM   t4
JOIN   t5
ON    t4.country_1990=t5.country_2016 AND
t4.name_of_region4=t5.name_of_region5
```

```
ORDER BY percent_forest_area_decrease DESC
LIMIT 5;

---what countries increased in for This country actually increased in
forest area from 1990 to 2016 by ____________________

-forest1990 -forest_area_2016-

SELECT country_name country, forest_area_sqkm forest_area
FROM forestation
WHERE (SELECT country_name
FROM forestation
WHERE country_forest_year=2016 AND forest_area_sqkm IS NOT NULL AND
country_name <>'World')
>
(SELECT country_name
FROM forestation
WHERE country_forest_year=1990 AND forest_area_sqkm IS NOT NULL AND
country_name <>'World')

---success story china and USA
forest2016>forest1990
WITH t1 AS
(SELECT country_name increase_country1,forest_area_sqkm forest_2016
FROM forestation
WHERE country_forest_year=2016 AND forest_area_sqkm IS NOT NULL AND
country_name <>'World'),

t2 AS
(SELECT country_name increase_country2,forest_area_sqkm forest_1990
FROM forestation
WHERE country_forest_year=1990 AND forest_area_sqkm IS NOT NULL AND
country_name <>'World')

SELECT increase_country2,(t1.forest_2016-t2.forest_1990)change_area
FROM t1
JOIN t2
ON t1.increase_country1=t2.increase_country2
WHERE t2.forest_1990<t1.forest_2016
ORDER BY 2 desc
```

```
LIMIT 5;

----percentage increase of success story--ICELAND

WITH t1 AS

(SELECT country_name increase_country1,forest_area_sqkm forest_2016
FROM forestation
WHERE country_forest_year=2016 AND forest_area_sqkm IS NOT NULL AND
country_name <>'World'),

t2 AS
(SELECT country_name increase_country2,forest_area_sqkm forest_1990
FROM forestation
WHERE country_forest_year=1990 AND forest_area_sqkm IS NOT NULL AND
country_name <>'World')

SELECT increase_country2,(t1.forest_2016-
t2.forest_1990)change_area,ROUND(CAST(((t1.forest_2016-
t2.forest_1990)/t1.forest_2016)*100 AS NUMERIC),2)percent_increase
FROM t1
JOIN t2
ON t1.increase_country1=t2.increase_country2
WHERE t2.forest_1990<t1.forest_2016
order by 3 desc
LIMIT 5;

--------- If countries were grouped by percent forestation in quartiles,
which group had the most countries in it in 2016?-----
---results 9
select count(distinct(country_name)),
CASE WHEN percent_forest <=25 THEN 'Q1'
     WHEN percent_forest BETWEEN 25 AND 50 THEN 'Q2'
     WHEN percent_forest BETWEEN 50 AND 75 THEN 'Q3'
     WHEN percent_forest >=75 THEN 'Q4'
     ELSE 'NONE' END AS quartiles
from forestation
WHERE country_forest_year=2016 AND percent_forest IS NOT NULL AND
country_name <>'World'
group by 2
```

```
order by 2;

-----List all of the countries that were in the 4th quartile (percent
forest > 75%) in 2016.-------RESULTS 9
WITH t1 AS

(SELECT count(distinct(country_name))country,country_name,region_name
name_region, percent_forest forest_change,
CASE WHEN percent_forest <=25 THEN 'Q1'
     WHEN percent_forest BETWEEN 25 AND 50 THEN 'Q2'
     WHEN percent_forest BETWEEN 50 AND 75 THEN 'Q3'
     WHEN percent_forest >=75 THEN 'Q4'
     ELSE 'NONE' END AS quartiles
     FROM forestation
WHERE country_forest_year=2016 AND percent_forest IS NOT NULL AND
country_name <>'World'
GROUP BY 2,3,4
)

SELECT country_name country,t1.name_region,t1.forest_change
FROM t1
WHERE quartiles='Q4'
ORDER BY 3 DESC;

---- How many countries had a percent forestation higher than the United
States in 2016- 100countries

SELECT count(distinct(country_name))
FROM forestation
WHERE percent_forest >
(SELECT percent_forest percent_forest
FROM   forestation
WHERE  country_forest_year=2016 AND country_name='United States'
AND percent_forest IS NOT NULL AND country_name <>'World');
```