Report for Forest Query into Global Deforestation, 1990 to 2016

Forest Query 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 Forest Query 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 **3.208%.**

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 km²**).

2. **REGIONAL OUTLOOK**

In 2016, the percent of the total land area of the world designated as forest was **31.34%.** 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 **32.21%.** 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 Percent	2016 Forest Percent
East Asia & Pacific	25.78	26.36
Europe & Central Asia	37.28	38.04
Latin America & Caribbean	51.03	46.16
Middle East & North Africa	1.78	2.07
North America	35.65	36.04
South Asia	16.51	17.51
Sub-Saharan Africa	30.67	28.79
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 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.**

United States and **China** 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%** 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
World	World	1324449
Brazil	Latin America & Caribbean	541510
Indonesia	East Asia & Pacific	282193.98
Myanmar	East Asia & Pacific	107234
Nigeria	Sub-Saharan Africa	106506

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_forestareachange
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:

Quartile	Number of Countries
1	86
2	74
3	36
4	9

The largest number of countries in 2016 were found in the **1 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	88
Gabon	Sub-Saharan Africa	90
Guyana	Latin America & Caribbean	84
Lao PDR	East Asia & Pacific	82
Micronesia, Fed. Sts.	East Asia & Pacific	92
Palau	East Asia & Pacific	88
Seychelles	Sub-Saharan Africa	88
Solomon Islands	East Asia & Pacific	78
Suriname	Latin America & Caribbean	98

5. RECOMMENDATIONS

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

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

  There were 3 files in world bank dataset which gave me 25 years of data on forest area of world by country & region. The forest area of world has decline by 3.2% which is equivalent to total area of Peru. There are 2 continents i.e., Latin America and Caribbean & Sub-Sahara Africa which has decreased their forestation area and caused decrease in world forest area from **32.42%** to **31.38.** There are 4 countries from continent Sub-Saharan Africa which has lost the highest percentage of their forest area. There are 86 countries in the world who are having their forest area less than 25% which is quite depressing. However, there are also countries such as India, United States, China, India, Russian federation, and Vietnam who have increased their forest area from 1990 to 2016.

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

1.The Primary focus should be on Nigeria as it is among the top 5 countries which has lost highest forest area. From 1990 to 2016, it has decreased its forest area by 61.8%.

2. Brazil, Indonesia, Myanmar, and Tanzania are the countries which has lost significant forest area over the period of time from 1990 to 2016. Therefore, we should really focus on these countries.

3. There are many countries in sub-Sahara continent which needs more attention as they have lost significant forest area.

Appendix:

```
CREATE view forestation
as
SELECT fa.country_code country_code,fa.country_name country_name, fa.year fa_year,
fa.forest_area_sqkm forest_area_sqkm, (la.total_area_sq_mi*2.59) total_area_sq_km,
(forest_area_sqkm/(la.total_area_sq_mi*2.59))*100 as forestpercent,
re.region region, re.income_group income_group
FROM forest_area fa
JOIN land_area la
ON fa.country_code = la.country_code
AND fa.year = la.year
JOIN regions re
ON fa.country_code = re.country_code
```

1.Global Situation

a.

```
SELECT sum(forest_area_sqkm)
FROM forest_area
WHERE country_name = 'World'
AND year = 1990
```

b.

```
SELECT sum(forest_area_sqkm)
FROM forest_area
WHERE country_name = 'World'
AND year = 2016
```

c.

```
SELECT (fa1.forest_area_sqkm) -  (fa2.forest_area_sqkm) as forestareachange
FROM forest_area fa1
JOIN forest_area fa2
ON fa1.country_name = fa2.country_name
WHERE fa1.year = 1990 and fa2.year = 2016
and fa1.country_name = 'World' and fa1.country_name = 'World'
```

d.

```
SELECT ((fa1.forest_area_sqkm) - (fa2.forest_area_sqkm))*100/ (fa1.forest_area_sqkm) as
forestareachange
FROM forest_area fa1
JOIN forest_area fa2
ON fa1.country_name = fa2.country_name
WHERE fa1.year = 1990 and fa2.year = 2016
and fa1.country_name = 'World' and fa2.country_name = 'World'
```

e.

```
SELECT country_name, year, (total_area_sq_mi*2.59) as total_land_area
    FROM land_area
    where year = 2016
 and round(CAST((total_area_sq_mi*2.59)AS NUMERIC),2) < (SELECT
(sum(fa1.forest_area_sqkm) - sum(fa2.forest_area_sqkm)) as forestareachange
FROM forest_area fa1
JOIN forest_area fa2
ON fa1.country_name = fa2.country_name
WHERE fa1.year = 1990 and fa2.year = 2016 and fa1.country_name = 'World')
order by 3 desc
limit 1
```

2.

```
SELECT re.region region,fa.year, ROUND(CAST(sum(fa.forest_area_sqkm) AS NUMERIC),2)
regional_forest_area, ROUND(CAST(sum(la.total_area_sq_mi*2.59) AS NUMERIC),2)
regional_land_area,
ROUND(CAST((sum(fa.forest_area_sqkm)/(sum(la.total_area_sq_mi*2.59)))*100 AS
NUMERIC),2) as percentforestarea
FROM forest_area fa
JOIN land_area la
ON fa.country_code = la.country_code
AND fa.year = la.year
JOIN regions re
ON fa.country_code = re.country_code
group by 1,2
having fa.year = 1990 or fa.year = 2016
order by 1,2
```

a.
FOREST PERCENT IN 2016

```
With cte1 as
      (SELECT year, sum(forest_area_sqkm) as total_forest_area
       FROM forest_area
       where year = 2016
       group by year),
cte2 as
     (SELECT year, sum(total_area_sq_mi*2.59) as total_land_area
      FROM land_area
      where year = 2016
      group by year)
SELECT ROUND(CAST((cte1.total_forest_area/cte2.total_land_area)*100 AS NUMERIC),2)
world_forest_percent
FROM cte1
JOIN cte2
ON cte1.year = cte2.year
```

REGION WITH HIGHEST PERCENT OF FOREST IN 2016

```
SELECT re.region region,fa.year, ROUND(CAST(sum(fa.forest_area_sqkm) AS NUMERIC),2)
regional_forest_area, ROUND(CAST(sum(la.total_area_sq_mi*2.59) AS NUMERIC),2)
regional_land_area,
ROUND(CAST((sum(fa.forest_area_sqkm)/(sum(la.total_area_sq_mi*2.59)))*100 AS
NUMERIC),2) as percentforestarea
FROM forest_area fa
JOIN land_area la
ON fa.country_code = la.country_code
AND fa.year = la.year
JOIN regions re
ON fa.country_code = re.country_code
group by 1,2
having fa.year = 2016
order by 5 desc
limit 1
```

REGION WITH LOWEST PERCENT OF FOREST IN 2016

```
SELECT re.region region,fa.year, ROUND(CAST(sum(fa.forest_area_sqkm) AS NUMERIC),2)
regional_forest_area, ROUND(CAST(sum(la.total_area_sq_mi*2.59) AS NUMERIC),2)
regional_land_area,
ROUND(CAST((sum(fa.forest_area_sqkm)/(sum(la.total_area_sq_mi*2.59)))*100 AS
NUMERIC),2) as percentforestarea
FROM forest_area fa
JOIN land_area la
ON fa.country_code = la.country_code
AND fa.year = la.year
JOIN regions re
ON fa.country_code = re.country_code
group by 1,2
having fa.year = 2016
order by 5 asc
limit 1
```

b.

FOREST PERCENT IN 1990

```
With cte1 as
      (SELECT year, sum(forest_area_sqkm) as total_forest_area
       FROM forest_area
       where year = 1990
       group by year),
cte2 as
     (SELECT year, sum(total_area_sq_mi*2.59) as total_land_area
      FROM land_area
      where year = 1990
      group by year)
SELECT ROUND(CAST((cte1.total_forest_area/cte2.total_land_area)*100 AS NUMERIC),2)
world_forest_percent
FROM cte1
JOIN cte2
ON cte1.year = cte2.year
```

REGION WITH HIGHEST PERCENT OF FOREST IN 1990

```
SELECT re.region region,fa.year, ROUND(CAST(sum(fa.forest_area_sqkm) AS NUMERIC),2)
regional_forest_area, ROUND(CAST(sum(la.total_area_sq_mi*2.59) AS
NUMERIC),2)regional_land_area,
ROUND(CAST(((sum(fa.forest_area_sqkm)/(sum(la.total_area_sq_mi*2.59)))*100) AS
NUMERIC),2) as percentforestarea
FROM forest_area fa
JOIN land_area la
ON fa.country_code = la.country_code
AND fa.year = la.year
JOIN regions re
ON fa.country_code = re.country_code
group by 1,2
having fa.year = 1990
order by 5 desc
limit 1
```

REGION WITH LOWEST PERCENT OF FOREST IN 1990

```
SELECT re.region region,fa.year, ROUND(CAST(sum(fa.forest_area_sqkm) AS NUMERIC),2)
regional_forest_area, ROUND(CAST(sum(la.total_area_sq_mi*2.59) AS
NUMERIC),2)regional_land_area,
ROUND(CAST(((sum(fa.forest_area_sqkm)/(sum(la.total_area_sq_mi*2.59)))*100) AS
NUMERIC),2) as percentforestarea
FROM forest_area fa
JOIN land_area la
ON fa.country_code = la.country_code
AND fa.year = la.year
JOIN regions re
ON fa.country_code = re.country_code
group by 1,2
having fa.year = 1990
order by 5 asc
limit 1
```

2 c.

DECREASE IN FOREST AREA FROM 1990 TO 2016 OF WORLD REGION

```
WITH cte1990 AS
      (SELECT re.region
region,fa.year,ROUND(CAST((sum(fa.forest_area_sqkm)/(sum(la.total_area_sq_mi*2.59)))*100
AS NUMERIC),2) as percentforestarea
       FROM forest_area fa
       JOIN land_area la
       ON fa.country_code = la.country_code
       AND fa.year = la.year
       JOIN regions re
       ON fa.country_code = re.country_code
       group by 1,2
       having fa.year = 1990
       order by 1,2),
  cte2016 AS
       (SELECT re.region region,fa.year ,
ROUND(CAST((sum(fa.forest_area_sqkm)/(sum(la.total_area_sq_mi*2.59)))*100 AS
NUMERIC),2) as percentforestarea
       FROM forest_area fa
       JOIN land_area la
       ON fa.country_code = la.country_code
       AND fa.year = la.year
       JOIN regions re
```

```
    ON fa.country_code = re.country_code
    group by 1,2
    having fa.year = 2016
    order by 1,2)
SELECT cte1990.region, cte1990.percentforestarea as forestpercent1990,
cte2016.percentforestarea as forestpercent2016
FROM cte1990
JOIN cte2016
ON cte1990.region = cte2016.region
where cte2016.percentforestarea < cte1990.percentforestarea
```

3.

a.

```
WITH forestarea_2016 AS
      (SELECT country_name, year, forest_area_sqkm
       FROM forest_area
       where year = 2016),
forestarea_1990 AS
       (SELECT country_name, year, forest_area_sqkm
       FROM forest_area
       where year = 1990)
SELECT forestarea_1990.country_name Country, re.region,
ROUND(CAST((forestarea_1990.forest_area_sqkm - forestarea_2016.forest_area_sqkm) AS
NUMERIC),2) as ForestAreaDecrease
FROM forestarea_1990
JOIN forestarea_2016
ON forestarea_1990.country_name = forestarea_2016.country_name
JOIN regions re
ON re.country_name = forestarea_2016.country_name
where (forestarea_1990.forest_area_sqkm - forestarea_2016.forest_area_sqkm) IS NOT NULL
ORDER BY 3 desc
LIMIT 5
```

b.

```
WITH forestarea_2016 AS
        (SELECT country_name, year, forest_area_sqkm
         FROM forest_area
         where year = 2016),
forestarea_1990 AS
         (SELECT country_name, year, forest_area_sqkm
         FROM forest_area
         where year = 1990)
SELECT forestarea_1990.country_name,forestarea_1990.forest_area_sqkm forest_area_1990,
forestarea_2016.forest_area_sqkm forest_area_2016,
ROUND(CAST((forestarea_1990.forest_area_sqkm - forestarea_2016.forest_area_sqkm) AS
NUMERIC),2) as difference_forestarea,
ROUND(CAST((forestarea_1990.forest_area_sqkm -
forestarea_2016.forest_area_sqkm)*100/(forestarea_1990.forest_area_sqkm) AS NUMERIC),2)
as difference_forestarea
FROM forestarea_1990
JOIN forestarea_2016
ON forestarea_1990.country_name = forestarea_2016.country_name
where (forestarea_1990.forest_area_sqkm - forestarea_2016.forest_area_sqkm) IS NOT NULL
ORDER BY 5 desc
LIMIT 5
```

c.

```
WITH cte1 as
    (SELECT fa.country_name country_name, forest_area_sqkm, total_area_sq_mi*2.59
total_area_sq_km ,ROUND(CAST((forest_area_sqkm/(total_area_sq_mi*2.59))*100 AS
NUMERIC),0) PercentForestation
     FROM forest_area fa
     JOIN land_area la
     ON fa.country_code = la.country_code
     AND fa.year = la.year
where fa.year= 2016 and la.year = 2016 AND forest_area_sqkm IS NOT NULL AND
total_area_sq_mi*2.59 IS NOT NULL),
cte2 as
   (SELECT country_name, PercentForestation,
      CASE WHEN PercentForestation <= 25 THEN 1
          WHEN PercentForestation >= 25 AND PercentForestation <= 50 THEN 2
          WHEN PercentForestation >= 50 AND PercentForestation <= 75 THEN 3
          ELSE 4
          END AS percentForestationGroup
    FROM cte1 )
SELECT percentForestationGroup, COUNT(*) as CountryCount
FROM cte1
JOIN cte2
ON cte1.country_name = cte2.country_name
GROUP BY 1
ORDER BY 2 DESC
```

d.

```
WITH cte1 as
    (SELECT fa.country_name country_name, forest_area_sqkm, total_area_sq_mi*2.59
total_area_sq_km ,ROUND(CAST((forest_area_sqkm/(total_area_sq_mi*2.59))*100 AS
NUMERIC),0) PercentForestation
     FROM forest_area fa
     JOIN land_area la
     ON fa.country_code = la.country_code
     AND fa.year = la.year
where fa.year= 2016 and la.year = 2016 AND forest_area_sqkm IS NOT NULL AND
total_area_sq_mi*2.59 IS NOT NULL),
cte2 as
   (SELECT country_name, PercentForestation,
      CASE WHEN PercentForestation <= 25 THEN 1
          WHEN PercentForestation >= 25 AND PercentForestation <= 50 THEN 2
          WHEN PercentForestation >= 50 AND PercentForestation <= 75 THEN 3
          ELSE 4
          END AS percentForestationGroup
    FROM cte1 )
SELECT  cte1.country_name, re.region, cte1.PercentForestation
FROM cte1
JOIN cte2
ON cte1.country_name = cte2.country_name
JOIN regions re
ON re.country_name = cte2.country_name
where cte2.percentForestationGroup = 4
```

e.

```
WITH cte1 as
    (SELECT fa.country_name country_name, forest_area_sqkm, total_area_sq_mi* 2.59
total_area_sq_km, fa.year as year, (forest_area_sqkm/(total_area_sq_mi*2.59))*100
PercentForestation
FROM forest_area fa
JOIN land_area la
ON fa.country_name = la.country_name
AND fa.year = la.year
where fa.year= 2016
AND fa.country_name= 'United States'),
 cte2 as
 (SELECT fa.country_name country_name, forest_area_sqkm, total_area_sq_mi*2.59
total_area_sq_km, fa.year as year, (forest_area_sqkm/(total_area_sq_mi*2.59))*100 AS
PercentForestation
FROM forest_area fa
JOIN land_area la
ON fa.country_name = la.country_name
AND fa.year = la.year
where fa.year= 2016)
SELECT COUNT(*)
FROM cte1
JOIN cte2
ON cte1.year = cte2.year
where cte2.PercentForestation > cte1.PercentForestation
```