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** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9**, a loss of **1324449**, 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 **1279999.9891**).

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 **46.16**%, 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
Sub-Saharan Africa	30.67	28.79
Latin America & Caribbean	51.03	46.16
World	32.42	31.38

The only regions of the world that decreased in percent forest area from 1990 to 2016 were **Sub-Saharan Africa** (dropped from **30.67** % to **28.79** %) and **Latin America & Caribbean**(**51.03** % to **46.16** %). 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 **527229.062**. 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** (**448029.062)**.

Russian Federation 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. **French Polynesia** increased in forest area by **27.32** % 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
Honduras	Latin America & Caribbean	32.74
Korea, Dem. People's Rep.	East Asia & Pacific	27.38
Zimbabwe	Sub-Saharan Africa	21.75
Cambodia	East Asia & Pacific	20.48
Timor-Leste	East Asia & Pacific	19.58

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 **East Asia & Pacific** and **Sub-Saharan Africa**. The countries are **Indonesia**, **Myanmar**, **Nigeria**, and **Tanzania**. The 5th country on the list is **Brazil**, which is in the **Latin America & Caribbean** region.

From the above analysis, we see that _ 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	73
50-75	38
75-100	9

The largest number of countries in 2016 were found in the **0-25** 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**
American Samoa	East Asia & Pacific	87.5000875
Micronesia, Fed. Sts.	East Asia & Pacific	91.85723907
Gabon	Sub-Saharan Africa	90.03764187
Guyana	Latin America & Caribbean	83.90144891
Lao PDR	East Asia & Pacific	82.10823176
Palau	East Asia & Pacific	87.60680855
Solomon Islands	East Asia & Pacific	77.86351779
Suriname	Latin America & Caribbean	98.25769397
Seychelles	Sub-Saharan Africa	88.41113674

How many countries had a percent forestation higher than the United States in 2016? - **94**

5. RECOMMENDATIONS

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

- *What have you learned from the World Bank data?*
  From the World bank data, We have got to know the forest area is decreasing and the land area is increasing over the time, which is leading to deforestation.

- *Which countries should we focus on over others?*
  For some countries, Forest area is decreasing over the time. We need to focus on the countries where the forest area has decreased from 1990 to 2016.

6. Appendix - SQL Queries

View -

```
/* View */
CREATE VIEW Forestation AS
SELECT f.country_code,f.year,f.country_name,f.forest_area_sqkm,
l.total_area_sq_mi,r.region,r.income_group,
((f.forest_area_sqkm * 100 ) / (l.total_area_sq_mi * 2.59)) AS Forest
FROM forest_area f
INNER JOIN land_area l ON f.country_code = l.country_code AND
f.year = l.year
INNER JOIN regions r ON
r.country_code = f.country_code
```

Global Situation

```
/*  Ques 1 */
/* What was the total forest area (in sq km) of the world in 1990?  */

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


/* Ques 2 */
/* What was the total forest area (in sq km) of the world in 2016?  */

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

/* Ques 3 */
/* What was the change (in sq km) in the forest area of the world from
1990 to 2016? */

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 change

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

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 percentchange


/* Ques 5 */
```

```sql
/*  If you compare the amount of forest area lost between 1990 and 2016,
to which country's total area in 2016 is it closest? */

select total_land_area, country_name
from (select sum(total_area_sq_mi*2.59)
     as total_land_area,country_name
   from forestation
     where year = 2016
     group by country_name
     order by total_land_area desc)
     as land_area_16
where total_land_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')))
limit 1;
```

Regional Outlook

```sql

/* 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 */

SELECT region,year,
(sum(forest_area_sqkm)*100)/(sum(total_area_sq_mi*2.59))
AS region_forest_area
INTO Regions_data
FROM Forestation
where year in ('1990','2016')
Group by region, year
```

```sql
/* Ques 1 */
/* What was the percent forest of the entire world in 2016? */

select cast((region_forest_area) as decimal(10,2))
from Regions_data
where year = 2016 and region='World'


/* Which region had the HIGHEST percent forest in 2016 */

select region, cast((region_forest_area) as decimal(10,2))
AS Highest_percent_forest
from Regions_data
where year = 2016
order by Highest_percent_forest  desc
limit 1;

/* Which region had the LOWEST percent forest in 2016 */

select region, cast((region_forest_area) as decimal(10,2))
AS lowest_percent_forest
from Regions_data
where year = 2016
order by Highest_percent_forest  asc
limit 1;


/* Ques 2 */
/* What was the percent forest of the entire world in 1990?  */

select cast((region_forest_area) as decimal(10,2))
from Regions_data
where year = 1990 and region='World'
```

```sql
/* Which region had the HIGHEST percent forest in 1990 */

select region, cast((region_forest_area) as decimal(10,2))
AS Highest_percent_forest
from Regions_data
where year = 1990
order by Highest_percent_forest  desc
limit 1;

/* Which region had the LOWEST percent forest in 1990 */

select region, cast((region_forest_area) as decimal(10,2))
AS lowest_percent_forest
from Regions_data
where year = 1990
order by Highest_percent_forest  asc
limit 1;



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

select r.region, cast((r.region_forest_area) as decimal(10,2))
AS Forest_percentage_1990, cast((d.region_forest_area) as decimal(10,2))
AS Forest_percentage_2016
from Regions_data r
INNER JOIN Regions_data d
ON r.region = d.region
where r.year = 1990 and d.year = 2016
and cast((r.region_forest_area) as decimal(10,2)) >
cast((d.region_forest_area) as decimal(10,2))
```

Country level details

```
/* Ques 1 */
/* Which country saw the largest amount increase in forest area from 1990
to 2016? */

select fa.country_name, fa.forest_area_sqkm
AS Forest_area_1990, faa.forest_area_sqkm
AS Forest_area_2016, faa.forest_area_sqkm- fa.forest_area_sqkm
AS difference
from forest_area fa
INNER JOIN forest_area faa
ON fa.country_name = faa.country_name
where fa.year = 1990 and faa.year = 2016
and fa.forest_area_sqkm < faa.forest_area_sqkm
order by difference desc
limit 1;


/* Which country saw the 2nd largest increase over this time period?  */

select fa.country_name, fa.forest_area_sqkm
AS Forest_area_1990, faa.forest_area_sqkm
AS Forest_area_2016, faa.forest_area_sqkm- fa.forest_area_sqkm
AS difference
from forest_area fa
INNER JOIN forest_area faa
ON fa.country_name = faa.country_name
where fa.year = 1990 and faa.year = 2016
and fa.forest_area_sqkm < faa.forest_area_sqkm
order by difference desc
limit 2
offset 1;
```

```sql
/* Ques 2 */

/* Which country saw the largest percent increase in forest area from 1990
to 2016?  */

select fa.country_name, fa.Forest
AS Forest_percentarea_1990, faa.Forest
AS Forest_percentarea_2016,
cast((faa.Forest) as decimal(10,2)) - cast((fa.Forest) as decimal(10,2))
AS difference
from Forestation fa
INNER JOIN Forestation faa
ON fa.country_name = faa.country_name
where fa.year = 1990 and faa.year = 2016
and fa.Forest < faa.Forest
order by difference desc
limit 1;


/* 2 largest countries in total land area*/

select country_name, sum(total_area_sq_mi*2.59)
as total_land_area from Forestation
where total_area_sq_mi is not null and country_name != 'World'
and year=2016
group by  country_name
order by total_land_area desc
limit 2;
```

```sql
/*  Que3 */

/* Which 5 countries saw the largest amount decrease in forest area from
1990 to 2016? */

select fa.country_name, fa.region, fa.forest_area_sqkm-
faa.forest_area_sqkm
AS difference
from Forestation fa
INNER JOIN Forestation faa
ON fa.country_name = faa.country_name
where fa.year = 1990 and faa.year = 2016
and fa.forest_area_sqkm > faa.forest_area_sqkm
and fa.country_name != 'World'
order by difference desc
limit 5;


/* Ques 4 */
/* Which 5 countries saw the largest percent decrease in forest area from
1990 to 2016? */

select fa.country_name, fa.region,
cast((fa.Forest) as decimal(10,2)) - cast((faa.Forest) as decimal(10,2))
AS difference
from Forestation fa
INNER JOIN Forestation faa
ON fa.country_name = faa.country_name
where fa.year = 1990 and faa.year = 2016
and fa.Forest > faa.Forest
order by difference desc
limit 5;
```

```sql
/* Ques - 5 */
/*  If countries were grouped by percent forestation in quartiles, which
group had the most countries in it in 2016? */

select t.range, count(*)
from (
 select
 case
   when Forest between 0 and 25 then ' 0- 25'
   when Forest between 25 and 50 then '25-50'
   when Forest between 50 and 75 then '50-75'
   else '75-100' end as range
 from Forestation where year = 2016 and Forest IS NOT NULL) t
group by t.range
order by t.range, count desc
limit 1;

/* Que - 6 */
/* List all of the countries that were in the 4th quartile (percent forest
> 75%) in 2016. */
select country_name, region, Forest
from Forestation
where Forest>75 and year = 2016

/* Que - 7 */
/* How many countries had a percent forestation higher than the United
States in 2016? */

select country_name
from Forestation
where year = 2016 and country_name != 'United States' and Forest >
(select Forest from Forestation
where country_name = 'United States' and year = 2016)
```