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

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
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
World	32.42	31.38
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 31.38%.

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 527,229.06. 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 79,200, much lower than the figure for China.

India and Russian Federation 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	282194
Myanmar	East Asia & Pacific	107234
Nigeria	Sub-Saharan Africa	106506
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
0-25%	85
25-50%	72
50-75%	38
75-100%	9

The largest number of countries in 2016 were found in the 1st 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
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 the World Bank data we can obviously notice that the total forest area of the world had decreased from 41,282,694.9 to 39,958,245.9, with an amount of 1,324,449 or 3.21% from 1990 to 2016. As we can see from table 2.1 that the total forest area of several states has increased, while some of them have decreased.

China and the United States have demonstrated an outstanding increase in terms of the total forest area. China and the United States have increased their total forest area by 527,229.06 and 79,200, respectively. In terms of decrease, we can obviously see in table 3.2 that four countries from Sub-Saharan Africa (Togo, Nigeria, Uganda, and Mauritania) and one country from Latin America & Caribbean are in the top 5 percent decrease in the forest area. Therefore, China and the United States can be perfect examples for others to improve their total forest area, because the total forest area of several countries has decreased from 1990 to 2016.

APPENDIX: SQL Queries Used

```
CREATE VIEW forestation AS
SELECT
f.country_code,f.country_name,f.year,f.forest_area_sqkm,l.total_area_sq_mi,r.region,r.income_group,100*f.forest_area_sqkm/(l.total_area_sq_mi*2.59) as percent_of_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 = f.country_code
AND r.country_code=l.country_code
```

Project part 1

1.1

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

1.2

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

1.3

```
With percent_2016 as (select country_name as c_n_1, forest_area_sqkm forest1
        from forestation
        where
        country_name = 'World'
        and year = 2016),
percent_1990 as (select country_name as c_n_2, forest_area_sqkm forest2
        from forestation
        where
        country_name = 'World'
        and year = 1990)
select forest1-forest2
from percent_2016 per_2016
join percent_1990 per_1990
on per_2016.c_n_1 = per_1990.c_n_2
```

1.4

```
With percent_2016 as (select country_name as c_n_1, forest_area_sqkm forest1
        from forestation
        where
        country_name = 'World'
        and year = 2016),
percent_1990 as (select country_name as c_n_2, forest_area_sqkm forest2
        from forestation
        where
        country_name = 'World'
        and year = 1990)
select 100*(forest1-forest2)/forest2
from percent_2016 per_2016
join percent_1990 per_1990
```

on per_2016.c_n_1 = per_1990.c_n_2

1.5

```
select country_name,
total_area_sq_mi*2.59 as total_area_sq_km,
ABS(
(
SELECT forest_area_sqkm
FROM forestation
WHERE
country_name = 'World'
AND year = 2016
) - (
SELECT
forest_area_sqkm
FROM
forestation
WHERE
country_name = 'World'
AND year = 1990
)
) AS total,
ABS(
total_area_sq_mi*2.59 -
ABS(
(
SELECT forest_area_sqkm
FROM forestation
WHERE
country_name = 'World'
AND year = 2016
) - (
SELECT
forest_area_sqkm
FROM
forestation
WHERE
country_name = 'World'
AND year = 1990
)
)
) AS difference
```

```
from forestation
where year = 2016
order by 4
limit 1
```

Project Part 2

```
With forest_precentage_1990 as (Select region as r,(SUM(forest_area_sqkm) * 100) /
(SUM(total_area_sq_mi)*2.59 ) as Sum_1990
                        from forestation
                        where year = 1990
                          group by 1),
forest_precentage_2016 as (Select region as r1,(SUM(forest_area_sqkm) * 100) /
(SUM(total_area_sq_mi)*2.59 ) as Sum_2016
                        from forestation
                        where year = 2016
                      group by 1),
joined_1990_2016 as ( select r,Sum_1990,Sum_2016
                from forest_precentage_1990 f_1990
                join forest_precentage_2016 f_2016
                on f_1990.r = f_2016.r1)
select r,ROUND(Sum_1990:: numeric, 2) sum_1990_decimal,ROUND(Sum_2016::
numeric, 2) as sum_2016_decimal
from joined_1990_2016
```

Project Part 3

3.1

```
With year_2016 as
(select country_name c_n_1, forest_area_sqkm forest1
from forestation f
where year = 2016),
year_1990 as
(select country_name c_n_2, forest_area_sqkm forest2
from forestation f
where year = 1990)
select c_n_1, forest1-forest2 as decrease
from year_2016
join year_1990
on year_2016.c_n_1 = year_1990.c_n_2
where c_n_1 != 'World'
order by decrease
limit 5
```

3.2

```
With year_2016 as
(select country_name c_n_1, forest_area_sqkm forest1
from forestation f
where year = 2016),
year_1990 as
(select  country_name c_n_2, forest_area_sqkm forest2
from forestation f
where year = 1990)
select c_n_1, ROUND((100*(forest1 - forest2)/forest2) :: numeric, 2) as decrease
from year_2016
join year_1990
on year_2016.c_n_1 = year_1990.c_n_2
order by decrease
limit 5
```

3.3

```
WITH year_2016 AS (SELECT country_name AS c_n_1,year as y_1, percent_of_forest AS
forest1
      FROM forestation
      WHERE year = 2016
      )
SELECT count(c_n_1), case
            WHEN  forest1>=75 THEN 'quartile_4'
            WHEN  forest1>=50 AND forest1<75 THEN 'quartile_3'
            WHEN  forest1>=25 AND forest1<50 THEN 'quartile_2'
            ELSE 'quartile_1' END AS quarts
           FROM year_2016
           where y_1 = 2016
           and forest1 is not null
           and c_n_1 != 'World'
           group by 2
           order by 1 desc
```

3.4

```
WITH year_2016 AS (SELECT country_name AS c_n_1, region as reg, year as y_1,
percent_of_forest AS forest1
      FROM forestation
      WHERE year = 2016
      )
SELECT reg,c_n_1, y_1, forest1, case
            WHEN  forest1>=75 THEN 'quartile_4'
            WHEN  forest1>=50 AND forest1<75 THEN 'quartile_3'
            WHEN  forest1>=25 AND forest1<50 THEN 'quartile_2'
```

```
 ELSE 'quartile_1' END AS quarts
FROM year_2016
where forest1 > 75
and y_1 = 2016
and forest1 is not null
and c_n_1 != 'World'
```

3.5

```
WITH year_2016 AS (SELECT country_name AS c_n_1,year as y_1,percent_of_forest AS forest1
    FROM forestation
    WHERE year = 2016
    )
SELECT count(c_n_1),y_1, case
     WHEN  forest1>=75 THEN 'quartile_4'
     WHEN  forest1>=50 AND forest1<75 THEN 'quartile_3'
     WHEN  forest1>=25 AND forest1<50 THEN 'quartile_2'
     ELSE 'quartile_1' END AS quarts
    FROM year_2016
    where forest1 > (select forest1
            from year_2016
            where c_n_1 = 'United States')
            and y_1 = 2016
    and forest1 is not null
    and c_n_1 != 'World'
    group by 2,3
```