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 _____3.21___%.

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 __1280000___).

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
North America	35.65	36.04

The only regions of the world that decreased in percent forest area from 1990 to 2016 were _Latin American & Carribean (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____. 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 ____79200__, 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
1st	85
fourth	9

2nd	72
third	38

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
Suriname	Latin America & Caribbean	98.2576939676578
Micronesia, Fed. Sts.	East Asia & Pacific	91.8572390715248
Gabon	Sub-Saharan Africa	90.0376418700565
Seychelles	Sub-Saharan Africa	88.4111367385789
Palau	East Asia & Pacific	87.6068085491204
American Samoa	East Asia & Pacific	87.5000875000875
Guyana	Latin America & Caribbean	83.9014489110682
Lao PDR	East Asia & Pacific	82.1082317640861
Solomon Islands	East Asia & Pacific	77.8635177945066

5. RECOMMENDATIONS

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

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

I have learnt that different developing countries actually have different levels of deforestation. China for example, have had significant improvement in increasing forest coverage, but Brazil had more decrease in forest coverage and was had the largest decrease in absolute numbers.

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

We should focus on countries which have the largest decrease in % forestation. These are countries mainly in the Sub-Saharan Africa Region.

Appendix 1: Answers in detail and SQL queries

```
DROP view if exists forestation;
CREATE VIEW forestation AS
SELECT fa.country_code code, fa.country_name country,
 fa.year "year", fa.forest_area_sqkm forest_area_sqkm,
 la.total_area_sq_mi total_area_sq_mi,
 r.region region, r.income_group income_group,
 100.0*(fa.forest_area_sqkm /
 (la.total_area_sq_mi * 2.59)) AS percentage
FROM forest_area fa, land_area la, regions r
WHERE (fa.country_code  = la.country_code
AND fa.year = la.year
 AND r.country_code = la.country_code);
SELECT * FROM forestation;
```

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.**

41282694.9

```
SELECT f.forest_area_sqkm
from forest_area as f
join  regions r
on r.country_code = f.country_code
where f.country_name = 'World' and  f.year = '1990';
```

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

```
SELECT f.forest_area_sqkm
from forest_area as f
join  regions r
on r.country_code = f.country_code
where f.country_name = 'World' and  f.year = '2016';
```

c. What was the change (in sq km) in the forest area of the world from 1990 to 2016?

1324449

```
select (
SELECT f.forest_area_sqkm
from forest_area as f
join  regions r
on r.country_code = f.country_code
where f.country_name = 'World' and  f.year = '1990')
-
(SELECT f.forest_area_sqkm
from forest_area as f
join  regions r
on r.country_code = f.country_code
where f.country_name = 'World' and  f.year = '2016')
as difference;
```

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

```
select (curr.forest_area_sqkm - prev.forest_area_sqkm)/prev.forest_area_sqkm * 100
FROM forest_area AS curr
join forest_area as prev
on (curr.year ='2016' and prev.year = '1990' and curr.country_name = 'World' and prev.country_name = 'World')
```

e. 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 1279999.9891 to 1,324,449

```
select country, (total_area_sq_mi * 2.59) as total_area_sqkm
from forestation
where year = 2016
order by total_area_sqkm
```

2. REGIONAL OUTLOOK

- 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, ...

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?
31.38
Latin America & Caribbean 46.16
Middle East & North Africa 2.07

```
select percentage
from forestation
where year = 2016
and country = 'World';
select region, round(cast(sum(forest_area_sqkm)/sum(total_area_sq_mi*2.59)*100 as numeric), 2) as
percentage_forest
from forestation
where year = 2016
group by region
order by percentage_forest desc;
```

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?
32.42
Latin America & Caribbean 51.03
Middle East & North Africa 1.78

```
select percentage
from forestation
where year = 1990
and country = 'World';
select region, round(cast(sum(forest_area_sqkm)/sum(total_area_sq_mi*2.59)*100 as numeric), 2) as
percentage_forest
from forestation
where year = 1990
group by region
order by percentage_forest desc;
```

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

Latin America & carribean and Sub-Saharan Africa decreased forest area

```
select region, round(cast(region_forest_1990/region_area_1990*100 as numeric),2) as percentage_1990,
round(cast(region_forest_2016/region_area_2016*100 as numeric),2) as percentage_2016
from(
select a.region, sum(a.forest_area_sqkm) as region_forest_1990,
sum(a.total_area_sq_mi*2.59) as region_area_1990,
sum(b.forest_area_sqkm) as region_forest_2016,
sum(b.total_area_sq_mi*2.59) as region_area_2016
from forestation a, forestation b
where a.year = '1990'
and b.year = '2016'
AND a.region = b.region
group by a.region
) as region_table
```

3. COUNTRY-LEVEL DETAIL

a. Which 5 countries saw the largest amount ~~decrease~~ increase in forest area from 1990 to 2016? What was the difference in forest area for each?

China	527229.062
United States	79200
India	69213.9844
Russian Federation	59395

Vietnam	55390

```
select a.country,  (b.forest_area_sqkm - a.forest_area_sqkm) as change_in_forest
from forestation a
join forestation b
on (a.year = '1990' and b.year = '2016')
and a.country = b.country
order by change_in_forest desc
```

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?
Togo, Nigeria, Uganda, Mauritania, Houduras

```
SELECT curr.country, curr.region,
 round(cast(100.0*(curr.forest_area_sqkm - prev.forest_area_sqkm) /
 prev.forest_area_sqkm as numeric),2) AS percentage
FROM forestation AS curr
JOIN forestation AS prev
 ON  (curr.year = '2016' AND prev.year = '1990')
 AND curr.country = prev.country
ORDER BY percentage;
```

c. If countries were grouped by percent forestation in quartiles, which group had the most countries in it in 2016?
The 1st group has the most countries

1st	85
fourth	9
2nd	72
third	38

```
select sub1.forest_levels, count(*)
from
(select country,
case
when percentage <=25
then '1st'
when percentage <=50 and percentage >25
then '2nd'
when percentage <=75 and percentage >50
then 'third'
else 'fourth'
end
as forest_levels
from forestation
where year = '2016' and country != 'World' and percentage is not null) as sub1
group by forest_levels
```

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

American Samoa	fourth
Micronesia, Fed. Sts.	fourth
Gabon	fourth
Guyana	fourth
Lao PDR	fourth
Palau	fourth
Solomon Islands	fourth
Suriname	fourth
Seychelles	fourth

```
select country, region, percentage from (
select country, region, percentage,
case
when percentage <=25
then '1st'
when percentage <=50 and percentage >25
then '2nd'
when percentage <=75 and percentage >50
then 'third'
else 'fourth'
end
as forest_levels
from forestation
where year = '2016' and country != 'World' and percentage is not null) as sub1
where forest_levels = 'fourth'
order by percentage desc
```

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

94

```
select count(country)
from forestation
where percentage > (
select percentage
from forestation
where country = 'United States' and
year = '2016' and country != 'World' and percentage is not null
) and
year = '2016' and country != 'World' and percentage is not null
```