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 3.2082 %.

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 1279995.047 Square Miles).

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 51.02 %, and the region with the lowest relative forestation was Middle East & North Africa, with 1.77% 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
Sub-Saharan Africa	30.67	28.79
East Asia & Pacific	25.78	26.36
South Asia	16.51	17.50
Middle East & North Africa	1.77	2.07

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 527229.062. 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.

China and 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 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 5 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	282193.98
Myanmar	East Asia & Pacific	107234.00
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	75.44
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 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	85
2	72
3	38
4	9

The largest number of countries in 2016 were found in the First 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	98.26
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Gabon	Sub-Saharan Africa	90.04

4. RECOMMENDATIONS

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

- *What have you learned from the World Bank data?*
    1. *Countries: Brazil, Indonesia, Myanmar, Nigeria and Tanzania have lost a lot of forest area 26 years.*
        - *They need attention.*
        - *Nigeria not only lost a large area of forestation, but as a country lost a high percentage as well.*
        - *These countries need attention to tr and make them more eco-friendly.*

2. *One a positive note, the following countries are the top countries to actually increase the area of forestation within their borders:*
    - *China, United States and India*

- *Which countries should we focus on over others?*
    - *Brazil, Indonesia, Myanmar, Nigeria and Tanzania*

5. Appendix: SQL queries used

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

SELECT forest_area_sqkm FROM
forest_area
WHERE (forest_area.year = 2016)
AND (forest_area.country_name = 'World');


CREATE VIEW FOREST2016
AS
SELECT SUB2016.forest_area_sqkm AS ForestAREA2016
FROM
(SELECT forest_area_sqkm FROM
forest_area
WHERE (forest_area.year = 2016)
AND (forest_area.country_name = 'World')) SUB2016;

CREATE VIEW FOREST1990
AS
SELECT SUB1990.forest_area_sqkm AS ForestAREA1990
FROM
(SELECT forest_area_sqkm FROM
forest_area
WHERE (forest_area.year = 1990)
AND (forest_area.country_name = 'World')) SUB1990;

SELECT ( FOREST2016.ForestAREA2016 - FOREST1990.ForestAREA1990)
CHANGE_iN_ForestArea_1990To2016
FROM  FOREST1990, FOREST2016;
```

```
SELECT
 FOREST1990.ForestAREA1990 AS ForestAREA1990,
 FOREST2016.ForestAREA2016 AS ForestAREA2016,
 ( FOREST2016.ForestAREA2016 - FOREST1990.ForestAREA1990) AS
CHANGE_iN_ForestArea, (100* (FOREST2016.ForestAREA2016 -
FOREST1990.ForestAREA1990)/FOREST1990.ForestAREA1990) AS
PERCENTAGECHANGE
FROM  FOREST1990, FOREST2016;


SELECT
 ABS( FOREST2016.ForestAREA2016 - FOREST1990.ForestAREA1990) AS
CHANGE_iN_ForestArea , sub2016.country_name, sub2016.total_area_sq_mi*2.58999 as
total_area_sqkm,
 ABS(ABS( FOREST2016.ForestAREA2016 - FOREST1990.ForestAREA1990)-
sub2016.total_area_sq_mi*2.58999) AS MINDIFF

FROM  FOREST1990, FOREST2016,
(SELECT * FROM land_area
WHERE  year = 2016 AND NOT(country_name = 'World') AND NOT(total_area_sq_mi = 0)
) sub2016
ORDER BY MINDIFF
LIMIT 9
 ;


SELECT Percent_ForestArea, country_name from
(select regions.region, forest_area.country_name, forest_area.year as
fyear,forest_area.forest_area_sqkm AS forestArea,  (land_area.total_Area_sq_mi*2.59) as
totalArea,
(100*forest_area.forest_area_sqkm)/(land_area.total_Area_sq_mi*2.59) as Percent_ForestArea
from forest_area
INNER JOIN land_area on
(forest_area.country_code = land_area.country_code) and
(forest_area.year = land_area.year)
INNER JOIN regions ON
land_area.country_code = regions.country_code
WHERE forest_area.year = 2016
ORDER BY regions.region, forest_area.country_name,forest_area.year

  ) AS subq1990To2016
  WHERE  fyear = 2016 AND country_name = 'World';
```

```
SELECT region,
    (100*sum(subq2O16.forestArea)/ SUM(subq2O16.landArea*2.59)) AS  thepercentage
 FROM
(select regions.region, forest_area.country_name, forest_area.year as fyear,
forest_area.forest_area_sqkm AS forestArea, land_area.total_Area_sq_mi AS landArea
from forest_area
INNER JOIN land_area on
(forest_area.country_code = land_area.country_code) and
(forest_area.year = land_area.year)
INNER JOIN regions ON
land_area.country_code = regions.country_code

  ) AS subq2O16
  WHERE  fyear = 2016 AND (NOT country_name ='World')
GROUP BY region ORDER BY 2;


SELECT Percent_ForestArea, country_name from
(select regions.region, forest_area.country_name, forest_area.year as
fyear,forest_area.forest_area_sqkm AS forestArea,  (land_area.total_Area_sq_mi*2.59) as
totalArea,
(100*forest_area.forest_area_sqkm)/(land_area.total_Area_sq_mi*2.59) as Percent_ForestArea
from forest_area
INNER JOIN land_area on
(forest_area.country_code = land_area.country_code) and
(forest_area.year = land_area.year)
INNER JOIN regions ON
land_area.country_code = regions.country_code
ORDER BY regions.region, forest_area.country_name,forest_area.year

  ) AS subq1990
  WHERE  fyear = 1990 AND country_name = 'World';


SELECT region,
    (100*sum(subq1990.forestArea)/ SUM(subq1990.landArea*2.59)) AS  thepercentage
 FROM
(select regions.region, forest_area.country_name, forest_area.year as fyear,
forest_area.forest_area_sqkm AS forestArea, land_area.total_Area_sq_mi AS landArea
from forest_area
INNER JOIN land_area on
(forest_area.country_code = land_area.country_code) and
(forest_area.year = land_area.year)
INNER JOIN regions ON
```

```
land_area.country_code = regions.country_code

  ) AS subq1990
  WHERE  fyear = 1990 AND (NOT country_name ='World')
GROUP BY region ORDER BY 2 DESC;
```

COUNTRY-LEVEL DETAIL

```
CREATE VIEW  Country1990 AS
select forest_area.country_name, forest_area.forest_area_sqkm AS forestArea
from forest_area
  WHERE  forest_area.year = 1990 AND NOT(forest_area.country_name = 'World')
  ORDER BY  forest_area.country_name,forest_area.year;
CREATE VIEW Country2016 AS
select forest_area.country_name, forest_area.forest_area_sqkm AS forestArea
from forest_area
  WHERE  forest_area.year = 2016 AND NOT(forest_area.country_name = 'World')
  ORDER BY  forest_area.country_name,forest_area.year;
SELECT   Country2016. Country, (Country1990.forest_area_sqkm  - Country2016.forest_area_sqkm)
AS 2016TO1990Decrease
FROM Country2016 JOIN
Country1990 ON
Country2016.country_name = Country1990.country_name
ORDER BY 2016TO1990Decrease DESC LIMIT 5;


SELECT   Country2016.country_name, (Country1990.forestArea  - Country2016.forestArea) AS
DecreaseFrom2016tO1990
FROM Country2016 JOIN
Country1990 ON
Country2016.country_name = Country1990.country_name
WHERE  (Country1990.forestArea  - Country2016.forestArea) > 0
ORDER BY DecreaseFrom2016tO1990 DESC LIMIT 5 ;


SELECT   Country2016.country_name, (Country2016.forestArea - Country1990.forestArea) AS
IncreaseFrom1990To2016
FROM Country2016 JOIN
Country1990 ON
Country2016.country_name = Country1990.country_name
WHERE  ( Country2016.forestArea - Country1990.forestArea ) > 0
ORDER BY IncreaseFrom1990To2016 DESC  LIMIT 5 ;
```

```
SELECT   Country2016.country_name, (Country2016.forestArea - Country1990.forestArea) AS
IncreaseFrom1990To2016,
 100*(Country2016.forestArea - Country1990.forestArea)/(Country1990.forestArea) AS
PercentageIncrease
FROM Country2016 JOIN
Country1990 ON
Country2016.country_name = Country1990.country_name
WHERE  ( Country2016.forestArea - Country1990.forestArea ) > 0
ORDER BY PercentageIncrease DESC  LIMIT 3 ;
```

QUARTILES QUERIES

```
CREATE VIEW CountryForestLand2016 AS
select forest_area.country_name,
regions.region,
100*forest_area.forest_area_sqkm/(land_area.total_area_sq_mi*2.59) as ForestTolandPercent
from forest_area
INNER JOIN regions
ON forest_area.country_code = regions.country_code
INNER JOIN land_area
ON  forest_area.country_code = land_area.country_code
  WHERE  forest_area.year = 2016  and land_area.year = 2016 AND NOT(forest_area.country_name =
'World') AND  (forest_area.forest_area_sqkm > 0) AND (land_area.total_area_sq_mi > 0)
  ORDER BY  forest_area.country_name;


select country_name, region,ForestTolandPercent,
          NTILE(4)OVER(ORDER BY foresttolandpercent) AS forestToLandPercentile
from CountryForestLand2016;



SELECT count(*), subgru.foresttolandpercentile
FROM(select country_name, region,ForestTolandPercent,
          NTILE(4)OVER(ORDER BY foresttolandpercent) AS forestToLandPercentile
from CountryForestLand2016
ORDER BY foresttolandpercent) subgru
group by subgru.foresttolandpercentile
order by subgru.foresttolandpercentile;


select country_name, region,ForestTolandPercent,
           CASE
        WHEN ForestTolandPercent  > 75 THEN 4
         WHEN ForestTolandPercent  > 50 THEN 3
         WHEN  ForestTolandPercent > 25 THEN 2
         WHEN ForestTolandPercent  > 0 THEN 1
   END as QuartileOfForestPerc
```

```
from CountryForestLand2016
ORDER BY foresttolandpercent;


select SUBPERC.quartileofforestperc, count(*) AS COUNTRYCOUNT
from
(select country_name, region,ForestTolandPercent,
          CASE
        WHEN ForestTolandPercent  > 75 THEN 4
         WHEN ForestTolandPercent  > 50 THEN 3
         WHEN  ForestTolandPercent > 25 THEN 2
         WHEN ForestTolandPercent  > 0 THEN 1
   END as QuartileOfForestPerc
from CountryForestLand2016
ORDER BY foresttolandpercent) SUBPERC
GROUP BY SUBPERC.quartileofforestperc
ORDER BY SUBPERC.quartileofforestperc;
```