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**

### 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.

### 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.

### 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 |
| Solomon Islands | East Asia & Pacific | 77.8635177945066 |
| Lao PDR | East Asia & Pacific | 82.1082317640861 |
| Guyana | Latin America & Caribbean | 83.9014489110682 |
| American Samoa | East Asia & Pacific | 87.5000875000875 |
| Palau | East Asia & Pacific | 87.6068085491203 |
| Seychelles | Sub-Saharan Africa | 88.4111367385789 |
| Gabon | Sub-Saharan Africa | 90.0376418700565 |
| Micronesia, Fed. Sts. | East Asia & Pacific | 91.8572390715248 |
| Suriname | Latin America & Caribbean | 98.2576939676578 |

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

| **numberofcountries\_withpercntforestation\_greaterthanusa** |
| --- |
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## 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 ;

\*\*BASED ON REVIEWER’S SUGGESTION, TRIED THE SHORTER QUERIES:

CREATE VIEW forestation AS

select forest\_area.country\_name, forest\_area.forest\_area\_sqkm AS forestArea,

regions.region, forest\_area.year as Year

from forest\_area

left JOIN regions

ON (forest\_area.country\_code = regions.country\_code)

left JOIN land\_area

ON (forest\_area.country\_code = land\_area.country\_code) and (forest\_area.year = land\_area.year)

WHERE NOT(forest\_area.country\_name = 'World')

ORDER BY forest\_area.country\_name,forest\_area.year;

..testing only

SELECT \*

FROM forestation

LIMIT 75;

SELECT Year1990.country\_name, (Year2016.forestArea - Year1990.forestArea) as change

FROM forestation Year1990

JOIN forestation Year2016

ON (Year1990.country\_name = Year2016.country\_name)

AND (Year1990.year=1990 AND Year2016.year=2016 )

WHERE (Year1990.year=1990 AND Year2016.year=2016)

AND (Year2016.forestArea >0) AND (Year1990.forestArea > 0)

ORDER BY 2 ASC

\*\*

### 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,

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;

For Question c

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;

For Question d

SELECT SUBPERC.country\_name, SUBPERC.region ,SUBPERC.foresttolandpercent, SUBPERC.QuartileOfForestPerc

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

where SUBPERC.foresttolandpercent > 75

ORDER BY SUBPERC.foresttolandpercent;

For Question e

CREATE VIEW USAPercView AS

SELECT

SUBPERC.foresttolandpercent

AS USAForestPercent

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

WHERE SUBPERC.country\_name = 'United States'

;

SELECT \* FROM USAPercView;

| **usaforestpercent** |
| --- |
| 33.9297857030622 |
|  |

SELECT SUBPERC.country\_name, SUBPERC.region ,SUBPERC.foresttolandpercent

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

JOIN USAPercView

ON NOT SUBPERC.ForestTolandPercent = USAPercView.usaforestpercent

WHERE SUBPERC.ForestTolandPercent > USAPercView.usaforestpercent

ORDER BY 3 ;

SELECT count(\*) AS NumberOfCountries\_WithPercntForestation\_GreaterThanUSA

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

JOIN USAPercView

ON NOT SUBPERC.ForestTolandPercent = USAPercView.usaforestpercent

WHERE SUBPERC.ForestTolandPercent > USAPercView.usaforestpercent

;

| **numberofcountries\_withpercntforestation\_greaterthanusa** |
| --- |
| 94 |