Report for Forest Query into Global Deforestation, 1990 to 2016

Forest Query 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 Forest Query 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.

As a data analyst, I used SQL to bring these tables together and to query them 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 sq km in 1990. As of 2016, the most recent year for which data was available, that number had fallen to39,958,245.9 sq km, a loss of 1,324,449 Sq km , or 3.21 %.

The forest area lost over this time period is slightly more than the entire land area of -1324449 listed for the year 2016 (which is Peru ).

## 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-SaharanAfrica | 30.67 % | 28.79% |
| Europe&CentralAsia | 37.258 | 38.04 |
| EastAsia&Pacific | 25.78 | 26.36 |
| SouthAsia | 16.51 | 17.51 |
| MiddleEast&NorthAfrica | 1.78 | 2.07 |
| World | 32.42 | 31.38 |
| NorthAmerica | 35.36 | 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 dropped (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 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 92.456%, much lower than the figure for China.

Russia and Canada 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. Icelands increased in forest area by 2.14% 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 3 countries had the largest decrease in forest area over the time period under consideration: China ,Sudan and Ethiopia

Table 3.1: Top 5 Amount Decrease in Forest Area by Country, 1990 & 2016:

|  |  |  |
| --- | --- | --- |
| Country | Region | Absolute Forest Area Change |
| Brazil | Latin America & Caribbean | 541510.00 |
| China | East Asia & Pacific | 527229.062 |
| Indonesia | East Asia & Pacific | 282193.98 |
| Sudan | Sub-Saharan Africa | 190355.29 |
| Ethiopia | Sub-Saharan Africa | 125396.00 |

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 |
| Iceland | Europe & Central Asia | 2.14% |
| French Polynesia | East Asia & Pacific | 1.82% |
| Bahrain | Middle East & Africa | 1.77% |
| Uruguay | Latin America & Caribbean | 1.34% |
| Dominican Republic | Latin America & Carribbean | 0.82% |

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 Latin America & Caribbean. The countries are Haiti , Nicaragua ,El Salvador and Panama. The 5th country on the list is Zimbabwe , which is in the Sub-Saharan Africa region.

From the above analysis, we see that Haiti 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 |
| Q-1 | 85 |
| Q-2 | 72 |
| Q-3 | 38 |
| Q-4 | 9 |

The largest number of countries in 2016 were found in the 1st quartile quartile.

There were 9 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 Forest Area Change |
| Bhutan | Southern Asia | 84.34% |
| Finland | Northern Europe | 76.47% |
| Gabon | Middle Africa | 88.18% |
| Guyana | South America | 84.48% |
| Laos | South East Asia | 77.62% |
| Suriname | South America | 91.92 |
| Sweden | Northern Europe | 76.87 |
| Vanuatu | Melanesia | 89.03 |
| Zambia | Eastern Africa | 76.38 |

## 4. RECOMMENDATIONS

Based on the report, deforestation continues to be a major problem around the world, with a significant decrease in forest areas over the past few years. In terms of recommendations, it is important for respective country’s governments around the world to take steps to encounter deforestation like promoting reforestation, implementing new policies, education and awareness of forest and its impact.

Analyzed reports show that countries such as Brazil, Indonesia have lost significant forest area over the years. Therefore, it is essential to address countries which have lost the highest forest area to understand the factors and develop interventions. Also, there are a handful of countries which have seen steady increase In forest loss like Madagascar, Nigeria, and Bolivia. The Forest Team should closely monitor those countries to address the situations causing the steady loss .

*Below are few recommendations to be considered:*

* Poverty
* Low Forest Management
* Global Collaboration
* Social/Economic Interventions

## 

## 5. APPENDIX: SQL Queries Used

CREATING A VIEW

CREATE VIEW forestation

AS

(SELECT f.country\_Code,

f.country\_name,

f.year,

f.forest\_area\_sqkm,

l.total\_area\_sq\_mi,

(l.total\_area\_sq\_mi \* 2.59) AS

“total\_area\_sqkm”,

f.forest\_area\_sqkm / (l.total\_area\_sq\_mi \* 2.59)) \* 100 AS

“ forest\_percentage”,

r.region, r.income\_group

FROM forest\_area as f

LEFT JOIN land\_area AS l on (f.country\_code = l.country\_code

AND f.year = l.year)

JOIN regions as r on r.country\_code = l.country\_code);

Answer – A -- Global Situation

Result : 41282694.9

SELECT SUM (forest\_area\_sqkm)

FROM forestation

WHERE country\_name = 'World'

AND year = 1990;

Answer – B – Global Situation

Result :39958245.9

SELECT SUM (forest\_area\_sqkm)

FROM forestation

WHERE country\_name = 'World'

AND year = 2016

SELECT SUM (forest\_area\_sqkm)

FROM forestation

WHERE year = '1990'

AND country\_name <> 'World';

Answer – C – Global Situation

Result : 1324449

WITH fore\_1990

AS (SELECT SUM(forest\_area\_sqkm) AS year\_1990

FROM forestation

WHERE year = 1990

AND country\_name = 'World'),

fore\_2016

AS (SELECT SUM(forest\_area\_sqkm) AS year\_2016

FROM forestation

WHERE year = 2016

AND country\_name = 'World'),

diff AS (SELECT year\_2016, year\_1990,year\_2016 - year\_1990 as diff

FROM fore\_2016,fore\_1990)

SELECT diff from diff

Answer – D – Global Situation

Result : 3.3145824351614 – ROUND ( 3%)

WITH fore\_2016

AS (SELECT SUM (forest\_area\_sqkm) AS year\_2016

FROM forestation

WHERE year = '2016'

AND country\_name = 'World'

GROUP BY year),

fore\_1990

AS (SELECT SUM (forest\_area\_sqkm) AS year\_1990

FROM forestation

WHERE year = '1990'

AND country\_name = 'World'

GROUP BY year)

SELECT year\_2016,

year\_1990,

Round (( ( year\_1990 - year\_2016 ) / year\_2016 ) \* 100) AS

"Diff (%)"

FROM fore\_1990

CROSS JOIN fore\_2016;

Answer – E – Global Situation

Result : Peru - 1324449

SELECT l.country\_name,

( l.total\_area\_sq\_mi \* 2.59 ) AS total\_area\_sq\_km,

( l.total\_area\_sq\_mi \* 2.59 ) + (SELECT

( f.forest\_area\_sqkm -

f1.forest\_area\_sqkm ) AS forest\_area\_lost

FROM forest\_area f

JOIN forest\_area f1

ON ( f.country\_code =

f1.country\_code

AND f.year = 2016

AND f1.year = 1990 )

ORDER BY forest\_area\_lost

LIMIT 1) AS

"forest\_area\_lost",

(SELECT ( f.forest\_area\_sqkm - f1.forest\_area\_sqkm ) AS forest\_area\_lost

FROM forest\_area f

JOIN forest\_area f1

ON ( f.country\_code = f1.country\_code

AND f.year = 2016

AND f1.year = 1990 )

ORDER BY forest\_area\_lost

LIMIT 1) AS

"forest\_area\_diff\_1990/2016"

FROM land\_area l

WHERE l.total\_area\_sq\_mi IS NOT NULL

ORDER BY Abs (( l.total\_area\_sq\_mi \* 2.59 ) + (SELECT

( f.forest\_area\_sqkm -

f1.forest\_area\_sqkm ) AS forest\_area\_lost

FROM forest\_area f

JOIN forest\_area f1

ON (

f.country\_code = f1.country\_code

AND f.year = 2016

AND f1.year = 1990 )

ORDER BY forest\_area\_lost

LIMIT 1))

LIMIT 1;

Answer – TABLE ( 2.1 ) – Regional Outlook

\*\* All the fill in the blank answers are based on table ( 2.1 ) created above from below Query.

----- WITH FUNCTION

WITH forest\_percentage

AS (SELECT r.region,

Sum(CASE

WHEN f.year = 1990 THEN f.forest\_area\_sqkm

ELSE 0

END) / Sum(CASE

WHEN l.year = 1990 THEN

l.total\_area\_sq\_mi \* 2.59

ELSE 0

END) \* 100 AS forest\_percentage\_1990,

Sum(CASE

WHEN f.year = 2016 THEN f.forest\_area\_sqkm

ELSE 0

END) / Sum(CASE

WHEN l.year = 2016 THEN

l.total\_area\_sq\_mi \* 2.59

ELSE 0

END) \* 100 AS forest\_percentage\_2016

FROM regions r

JOIN land\_area l

ON r.country\_code = l.country\_code

JOIN forest\_area f

ON r.country\_code = f.country\_code

AND l.year = f.year

GROUP BY r.region)

SELECT region,

Cast(forest\_percentage\_1990 AS NUMERIC (10, 2)) AS forest\_percentage\_1990,

Cast(forest\_percentage\_2016 AS NUMERIC (10, 2)) AS

forest\_percentage\_2016

FROM forest\_percentage;

Answer – A – Country Level Details

Result : Top 5 Amount Decrease in Forest

SELECT country\_name

AS

country,

region,

Round(Abs(forest\_area\_sqkm\_2016 - forest\_area\_sqkm\_1990) : : NUMERIC,

2)

AS

absolute\_forest\_area\_change

FROM (SELECT f.country\_code,

f.country\_name,

r.region,

Sum(CASE

WHEN f.year = 1990 THEN f.forest\_area\_sqkm

ELSE 0

end) AS forest\_area\_sqkm\_1990,

Sum(CASE

WHEN f.year = 2016 THEN f.forest\_area\_sqkm

ELSE 0

end) AS forest\_area\_sqkm\_2016

FROM forestation f

JOIN regions r

ON f.country\_code = r.country\_code

WHERE f.country\_code != 'WLD'

GROUP BY f.country\_code,

f.country\_name,

r.region) AS sub

ORDER BY absolute\_forest\_area\_change DESC

LIMIT 5;

Answer – B – Country Level Detail

Result : Top 5 Percent Decrease in Forest

SELECT f.country\_name AS country,

r.region,

CASE

WHEN Sum(

CASE

WHEN f.year = 1990 THEN f.forest\_area\_sqkm

ELSE 0

END) = 0 THEN NULL

ELSE Round(((Sum(

CASE

WHEN f.year = 2016 THEN f.forest\_area\_sqkm

ELSE 0

END) - Sum(

CASE

WHEN f.year = 1990 THEN f.forest\_area\_sqkm

ELSE 0

END)) / Sum(

CASE

WHEN f.year = 1990 THEN f.forest\_area\_sqkm

ELSE 0

END)) : : numeric, 2)

END AS percentage\_forest\_area\_change

FROM forestation f

JOIN regions r

ON f.country\_code = r.country\_code

WHERE f.year IN (1990,

2016)

GROUP BY f.country\_name,

r.region

ORDER BY percentage\_forest\_area\_change DESC nulls last LIMIT 5;

Answer – C – Country Level Detail

Result : Q1 – 85, Q2 – 72, Q3 – 38, Q4 – 9

SELECT COUNT (country\_name), CASE

WHEN forest\_percentage >= 75 THEN 'Q4'

WHEN forest\_percentage >= 50 THEN 'Q3'

WHEN forest\_percentage >= 25 THEN 'Q2'

ELSE

'Q1'

END AS "quartiles"

FROM forestation

WHERE year = '2016'

AND forest\_percentage IS NOT NULL

AND country\_name != 'World'

GROUP BY quartiles

ORDER BY quartiles

Answer – D – Country Level Detail

Result : 9 countries

SELECT f.country\_name,

Round(( f.forest\_area\_sqkm : : NUMERIC / l.total\_area\_sq\_mi : : NUMERIC ) \*

100.0,

2) AS percentage\_by\_forest,

r.region

FROM forestation f

JOIN land\_area l

ON f.country\_code = l.country\_code

AND f.year = l.year

JOIN regions r

ON f.country\_code = r.country\_code

WHERE f.year = 2016

AND f.forest\_percentage > 0.75

ORDER BY percentage\_by\_forest DESC;

Answer – E – Country Level Detail

Result : 4

SELECT COUNT (\*) AS higher\_united\_states\_2016

FROM forestation f

JOIN land\_area l

ON f.country\_code = l.country\_code

AND f.year = l.year

WHERE f.year = 2016

AND f.forest\_percentage > (SELECT

f2.forest\_area\_sqkm / l2.total\_area\_sq\_mi

FROM forestation f2

JOIN land\_area l2

ON f2.country\_code = l2.country\_code

AND f2.year = l2.year

WHERE f2.country\_code = 'USA'

AND f2.year = 2016);