Report for Forest Query 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 41,282,694.9sqkm in 1990. As of 2016, the most recent year for which data was available, that number had fallen to39,958,245.9sqkm, a loss of 1,324,449sqkm, 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 1,279,999.9891sqkm).

## 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 | 51.0299798667514 | 46.1620721996047 |
| Middle East & North Africa | 1.77524062469353 | 2.06826486871501 |
| Sub-Saharan Africa | 30.6741454610006 | 28.7881883550464 |
| East Asia & Pacific | 25.7760953973175 | 26.3586765000485 |
| Europe & Central Asia | 37.2839398564019 | 38.0414216032517 |
| North America | 35.6511790009015 | 36.0393609681438 |
| South Asia | 16.510767001421 | 17.5058634081534 |

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 527,229.06sqkm. 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 79200sqkm, 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 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 | 282193.98 |
| 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 |
| Ugnada | 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-Sahran 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 |
| --- | --- |
| 1st | 85 |
| 2nd | 72 |
| 3rd | 38 |
| 4th | 9 |

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 |
| --- | --- | --- |
| Solomon Islands | East Asia & Pacific | 77.86 |
| Lao PDR | East Asia & Pacific | 82.11 |
| Guyana | Latin America & Caribbean | 83.90 |
| American Samoa | East Asia & Pacific | 87.50 |
| Palau | East Asia & Pacifc | 87.61 |
| Seychelles | Sub-Saharan Africa | 88.41 |
| Gabon | Sub-Saharan Africa | 90.04 |
| Micronesia, Fed. Sts. | East Asia & Pacific | 91.86 |
| Suriname | Latin America & Caribbean | 98.26 |

3e) 94 countries had a percent forestation higher than the United States in 2016

## 5. RECOMMENDATIONS

After reviewing the World Bank Data, I have learned that the majority of the forest area around the world is shrinking over time. It is alarming that we have lost a forest area the size of Peru in 16 years. A majority of the countries in the world are ranked in the 1st quartile of percent forestation which means that 85 countries have less than or equal to 25% forestation and less than half of the world rank in the 3rd and 4th quartile. We should bring attention to the rate of decrease of forest area to the countries that decreased the most in terms of sqkm as well as percent forest area change. At the rate that they are losing forest area, they will have no more forests in their country in another decade.

We can also propose solutions by giving these countries alternative options than choosing deforestation or regrowing their forest to try and bring back life as a long-term alternative. Throughout this data pull, it consistently shows us that a major region of focus for halting deforestation should be Sub-Saharan Africa. We should focus on those countries that had the largest decrease in percent forest area (Togo, Nigeria, Uganda, Mauritania, & Honduras) and again, the countries who had the largest decrease in forest area by sqkm (Brazil, Indonesia, Myanmar, Tanzania, & Nigeria).

APPENDIX

Part 1

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 total\_area\_sqkm,

r.region,

r.income\_group,

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

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 = l.country\_code

1a)

SELECT country\_name, SUM(forest\_area\_sqkm) sum

FROM forestation

WHERE country\_name = 'World' AND year = '1990'

GROUP BY 1

1b)

SELECT country\_name, SUM(forest\_area\_sqkm) sum

FROM forestation

WHERE country\_name = 'World' AND year = '2016'

GROUP BY 1

1c)

SELECT a.country\_name, (a.forest\_area\_sqkm - b.forest\_area\_sqkm) AS difference

FROM forestation a

JOIN forestation b

ON a.country\_name = b.country\_name

WHERE a.year = '1990' AND b.year = '2016' AND a.country\_name = 'World'

GROUP BY 1, 2

1d)

WITH t2 AS (SELECT country\_name, SUM(forest\_area\_sqkm) sum2

FROM forestation

WHERE country\_name = 'World' AND year = '2016'

GROUP BY 1),

t1 AS (SELECT country\_name, SUM(forest\_area\_sqkm) sum1

FROM forestation

WHERE country\_name = 'World' AND year = '1990'

GROUP BY 1),

t3 AS (SELECT t1.country\_name, (t1.sum1 - t2.sum2) AS difference

FROM t1

JOIN t2

ON t1.country\_name = t2.country\_name)

SELECT (t3.difference/t1.sum1)\*100 AS percent

FROM t3

JOIN t1

ON t1.country\_name = t3.country\_name

JOIN t2

ON t2.country\_name = t1.country\_name

1e)

SELECT country\_name, ABS(1324449 - total\_area\_sqkm) AS Land\_difference

FROM forestation

WHERE year = '2016'

ORDER BY Land\_difference

LIMIT 1

PART 2

CREATE VIEW regional\_outlook AS

WITH t1\_1990 AS (SELECT region,year, ((sum(forest\_area\_sqkm) /

sum(total\_area\_sqkm)) \* 100) AS percent\_forest1990

FROM forestation

WHERE country\_name != 'World' AND year = '1990'

GROUP BY 1,2),

t2\_2016 AS (SELECT region,year, ((sum(forest\_area\_sqkm) /

sum(total\_area\_sqkm)) \* 100) AS percent\_forest2016

FROM forestation

WHERE country\_name != 'World' AND year = '2016'

GROUP BY 1,2)

SELECT t1\_1990.region, percent\_forest1990, percent\_forest2016

FROM t1\_1990

JOIN t2\_2016

ON t1\_1990.region = t2\_2016.region

2a)

SELECT region, year, ((sum(forest\_area\_sqkm) /sum(total\_area\_sqkm)) \* 100) AS percent\_forest2016

FROM forestation

WHERE region = 'World' AND year = '2016'

GROUP BY 1,2

SELECT region, ROUND(percent\_forest2016::numeric,2) pct

FROM regional\_outlook

GROUP BY 1, 2

ORDER BY 2

LIMIT 1

SELECT region, ROUND(percent\_forest2016::numeric,2) pct

FROM regional\_outlook

GROUP BY 1, 2

ORDER BY 2 DESC

LIMIT 1

2b)

SELECT region, year, ((sum(forest\_area\_sqkm) /sum(total\_area\_sqkm)) \* 100) AS percent\_forest2016

FROM forestation

WHERE region = 'World' AND year = '1990'

GROUP BY 1,2

SELECT region, ROUND(percent\_forest1990::numeric,2) pct

FROM regional\_outlook

GROUP BY 1, 2

ORDER BY 2

LIMIT 1

SELECT region, ROUND(percent\_forest1990::numeric,2) pct

FROM regional\_outlook

GROUP BY 1, 2

ORDER BY 2 DESC

LIMIT 1

2c)

SELECT region, percent\_forest1990, percent\_forest2016

FROM regional\_outlook

WHERE percent\_forest1990 > percent\_forest2016

GROUP BY 1, 2, 3

PART 3

3a)

SELECT a.country\_name, a.region, ROUND(a.forest\_area\_sqkm::numeric,2) AS forest\_area1990, ROUND(b.forest\_area\_sqkm::numeric,2) AS forest\_area2016, ROUND((a.forest\_area\_sqkm - b.forest\_area\_sqkm)::numeric,2) AS difference

FROM forestation a

JOIN forestation b

ON a.country\_name = b.country\_name AND a.year = 1990 AND b.year = 2016

WHERE a.forest\_area\_sqkm IS NOT NULL AND b.forest\_area\_sqkm IS NOT NULL AND a.country\_name != 'World'

ORDER BY 5 DESC

LIMIT 5

**If using ABS**

SELECT a.country\_name, a.region, ROUND(a.forest\_area\_sqkm::numeric,2) AS forest\_area1990, ROUND(b.forest\_area\_sqkm::numeric,2) AS forest\_area2016, ROUND(ABS(a.forest\_area\_sqkm - b.forest\_area\_sqkm)::numeric,2) AS difference

FROM forestation a

JOIN forestation b

ON a.country\_name = b.country\_name AND a.year = 1990 AND b.year = 2016

WHERE a.forest\_area\_sqkm IS NOT NULL AND b.forest\_area\_sqkm IS NOT NULL AND a.country\_name != 'World'

ORDER BY 5 DESC

LIMIT 6

For the word doc

SELECT a.country\_name, a.region, ROUND(a.forest\_area\_sqkm::numeric,2) AS forest\_area1990, ROUND(b.forest\_area\_sqkm::numeric,2) AS forest\_area2016, ROUND((b.forest\_area\_sqkm - a.forest\_area\_sqkm)::numeric,2) AS difference

FROM forestation a

JOIN forestation b

ON a.country\_name = b.country\_name AND a.year = 1990 AND b.year = 2016

WHERE a.forest\_area\_sqkm IS NOT NULL AND b.forest\_area\_sqkm IS NOT NULL AND a.country\_name != 'World'

ORDER BY 5 DESC

LIMIT 2

For question regarding largest percent change in forest area

SELECT a.country\_name, a.region, ROUND(a.forest\_area\_sqkm::numeric,2) AS forest\_area1990, ROUND(b.forest\_area\_sqkm::numeric,2) AS forest\_area2016, ROUND((a.forest\_area\_sqkm - b.forest\_area\_sqkm)::numeric,2) AS difference, ABS(ROUND((((a.forest\_area\_sqkm - b.forest\_area\_sqkm)/a.forest\_area\_sqkm)\*100)::numeric, 2)) AS abs\_pct\_change

FROM forestation a

JOIN forestation b

ON a.country\_name = b.country\_name AND a.year = 1990 AND b.year = 2016

WHERE a.forest\_area\_sqkm IS NOT NULL AND b.forest\_area\_sqkm IS NOT NULL AND a.country\_name != 'World'

ORDER BY 6 DESC

LIMIT 1

3b)

SELECT a.country\_name, a.region, ROUND(a.forest\_area\_sqkm::numeric,2) AS forest\_area1990, ROUND(b.forest\_area\_sqkm::numeric,2) AS forest\_area2016, ROUND((a.forest\_area\_sqkm - b.forest\_area\_sqkm)::numeric,2) AS difference, ROUND((((a.forest\_area\_sqkm - b.forest\_area\_sqkm)/a.forest\_area\_sqkm)\*100)::numeric, 2) AS pct\_change

FROM forestation a

JOIN forestation b

ON a.country\_name = b.country\_name AND a.year = 1990 AND b.year = 2016

WHERE a.forest\_area\_sqkm IS NOT NULL AND b.forest\_area\_sqkm IS NOT NULL AND a.country\_name != 'World'

ORDER BY 6 DESC

LIMIT 5

3c)

WITH t1 AS (SELECT country\_name, forest\_percent,

CASE

WHEN forest\_percent <=25 THEN '1st'

WHEN forest\_percent >25 AND forest\_percent <=50 THEN '2nd'

WHEN forest\_percent >50 AND forest\_percent <=75 THEN '3rd'

WHEN forest\_percent >=75 THEN '4th'

ELSE '1st' END AS quartile

FROM forestation

WHERE country\_name != 'World' AND year = 2016 AND forest\_percent IS NOT NULL)

SELECT COUNT(\*) AS countries, quartile

FROM t1

GROUP BY 2

ORDER BY 1 DESC

3d)

SELECT country\_name, forest\_percent, region,

CASE

WHEN forest\_percent <25 THEN '1st'

WHEN forest\_percent >25 AND forest\_percent <50 THEN '2nd'

WHEN forest\_percent >50 AND forest\_percent <75 THEN '3rd'

WHEN forest\_percent >75 THEN '4th'

ELSE '1st' END AS quartile

FROM forestation

WHERE country\_name != 'World' AND year = 2016 AND forest\_percent >75

3e)

SELECT count(\*)

FROM forestation

WHERE forest\_percent > (SELECT forest\_percent

FROM forestation

WHERE country\_name = 'United States' AND year = 2016) AND year = 2016