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 **3.20824258980244% ~ 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 **1279999.9891**).

## 2. **REGIONAL OUTLOOK**

In 2016, the percentage of the total land area of the world designated as forest was **31.3755709643095 ~ 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 percentage 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 |
| 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 | 17.51 |
| Middle East & North Africa | 1.78 | 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 sq km,** 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 **213.664588870028 % ~ 213.67%** 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 | 61.8 |
| 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

### QUARTILES

Table 3.3: Count of Countries Grouped by Forestation Percent Quartiles, 2016:

|  |  |
| --- | --- |
| Quartile | Number of Countries |
| 25-50% | 72 |
| 75 - 100% | 9 |
| 0-25% | 85 |
| 50-75% | 38 |

The largest number of countries in 2016 were found in the **0-25%** 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 | 98.25769397 |
| Micronesia, Fed. Sts. | East Asia & Pacific | 91.85723907 |
| Gabon | Sub-Saharan Africa | 90.03764187 |
| Seychelles | Sub-Saharan Africa | 88.41113674 |
| Palau | East Asia & Pacific | 87.60680855 |
| American Samoa | East Asia & Pacific | 87.5000875 |
| Guyana | Latin America & Caribbean | 83.90144891 |
| Lao PDR | East Asia & Pacific | 82.10823176 |
| Solomon Islands | East Asia & Pacific | 77.86351779 |

## 5. RECOMMENDATIONS

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

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

Based on my findings after analyzing the provided data, it can be seen that forestation rate is declining with about 3.21% between 1990 to 2016. The findings also highlight the world has lost an entire forest size area more than entire Peru land area as of 2016.

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

Again, based on my findings after analyzing the provided data, the area of concerns are mostly countries located in Sub-Saharan Africa Region. We see most of the countries in this region have considerably decrease in forestation between 1990 and 2016. The Countries that should be focus on are Togo, Nigeria, Uganda and Mauritania. We can study what China has done differently to increase its forestation as a means to remediate issue in Sub-Saharan Africa Region

**Appendix: SQL queries used**

**Database SCHEMA**

|  |  |  |
| --- | --- | --- |
| **forest\_area** | **land\_area** | **regions** |
| country\_code | country\_code | country\_name |
| country\_name | country\_name | country\_code |
| year | year | region |
| forest\_area\_sqkm | total\_area\_sq\_mi | income\_group |

CREATE VIEW forestation AS

SELECT f.country\_name  "Country Name",

       f.country\_code  "Country Code",

       f.year,

       f.forest\_area\_sqkm  "Forest\_Area",

       l.total\_area\_sq\_mi "Area Sq\_mi",

       l.total\_area\_sq\_mi \* 2.59 "Total Area\_sqkm",

       r.region "Region",

       r.income\_group "Income Group",

       100 \* (f.forest\_area\_sqkm \* 100 /(l.total\_area\_sq\_mi \* 259))  "Forest Percentage"

FROM forest\_area f

JOIN land\_area l

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

AND f.year = l.year

JOIN regions r

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

**/\* GLOBAL SITUATION Question**

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.

\*/

SELECT SUM("Forest Area")

FROM forestation

WHERE year = 1990

AND "Region" = 'World';

/\* GLOBAL SITUATION Question

What was the total forest area (in sq km) of the world in 2016?

Please keep in mind that the country record in the table is denoted as “World.”

\*/

SELECT SUM("Forest\_Area")

FROM forestation

WHERE year = 2016

AND "Region" = 'World';

/\* GLOBAL SITUATION Question

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

\*/

SELECT (f1."Forest\_Area" - f2."Forest\_Area") AS "Forest\_Area\_Change"

FROM forestation f1,

forestation f2

WHERE

f1.year = 1990

AND f1."Region" = 'World'

AND f2.year = 2016

AND f2."Region" = 'World';

/\* What was the percent change in forest area of the world between 1990 and 2016? \*/

SELECT (f1."Forest\_Area" - f2."Forest\_Area") \* 100/f1."Forest\_Area"

AS "Forest\_Percent\_Change"

FROM forestation f1,

forestation f2

WHERE

f1.year = 1990

AND f1."Region" = 'World'

AND f2.year = 2016

AND f2."Region" = 'World';

/\* Output : 3.20824258980244 \*/

/\*

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?

\*/

SELECT "Country Name", "Total\_Area\_Sqkm"

FROM forestation

WHERE "Year" = 2016 AND

ORDER BY "Total\_Area\_Sqkm" DESC;

OutPut : Peru with 1279999.9891

## 

## **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) \*/**

SELECT "Region", ROUND(CAST((forest\_region\_1990/region\_1990) \* 100 AS NUMERIC), 2)

AS percent\_forest\_1990,

ROUND(CAST((forest\_region\_2016/region\_2016) \* 100 AS NUMERIC), 2)

AS percent\_forest\_2016

FROM(SELECT SUM(f1."Forest\_Area") forest\_region\_1990,

SUM(f1."Total Area\_sqkm") region\_1990,

f1."Region",

SUM(f2."Forest\_Area") forest\_region\_2016,

SUM(f2."Total Area\_sqkm") region\_2016

FROM forestation f1,

forestation f2

WHERE f1.year = '1990'

AND f1."Country Name" NOT LIKE 'World'

AND f2.year = '2016'

AND f2."Country Name" NOT LIKE 'World'

AND f1."Region" = f2."Region"

GROUP BY f1."Region") percent\_region

ORDER BY percent\_forest\_1990 DESC;

/\* What was the percent forest of the entire world in 2016? \*/

SELECT "Forest\_Area" \* 100/"Total Area\_sqkm" AS "Percent\_Forest\_2016"

FROM forestation

WHERE year = 2016

AND "Country Name" = 'World';

-- 31.3755709643095

/\* Which region had the HIGHEST percent forest in 2016 ROUND to 2 decimal places\*/

SELECT "Region",

ROUND(CAST(forest\_percent AS numeric), 2) AS percent

FROM

(SELECT "Region", SUM("Forest\_Area")\* 100/SUM("Total Area\_sqkm") AS forest\_percent

FROM forestation

WHERE year = 2016

GROUP BY "Region") sub

ORDER BY forest\_percent DESC

LIMIT 5;

|  |  |
| --- | --- |
| **Region** | **percent** |
| **Latin America & Caribbean** | 46.16 |
| **Europe & Central Asia** | 38.04 |
| **North America** | 36.04 |
| **World** | 31.38 |
| **Sub-Saharan Africa** | 28.79 |

/\* Which region had the LOWEST percent forest in 2016 ROUND to 2 decimal places\*/

SELECT "Region",

ROUND(CAST(forest\_percent AS numeric), 2) AS percent

FROM

(SELECT "Region", SUM("Forest\_Area")\* 100/SUM("Total Area\_sqkm") AS forest\_percent

FROM forestation

WHERE year = 2016

GROUP BY "Region") sub

ORDER BY forest\_percent

LIMIT 1;

|  |  |
| --- | --- |
| **Region** | **percent** |
| **Middle East & North Africa** | 2.07 |

/\*What was the percent forest of the entire world in 1990?\*/

SELECT "Forest\_Area" \* 100/"Total Area\_sqkm" AS "Percent\_Forest\_1990"

FROM forestation

WHERE year = 1990

AND "Country Name" = 'World';

|  |
| --- |
| **Percent\_Forest\_1990** |
| 32.4222035575689 |

/\*Which region had the HIGHEST percent forest in 1990 \*/

SELECT "Region",

ROUND(CAST(forest\_percent AS numeric), 2) AS Percent

FROM

(SELECT "Region", SUM("Forest\_Area")\* 100/SUM("Total Area\_sqkm") AS forest\_percent

FROM forestation

WHERE year = 1990

GROUP BY "Region") sub

ORDER BY forest\_percent DESC

LIMIT 1;

/\*Which region had the LOWEST percent forest in 1990 \*/

SELECT "Region",

ROUND(CAST(forest\_percent AS numeric), 2) AS Percent

FROM

(SELECT "Region", SUM("Forest\_Area")\* 100/SUM("Total Area\_sqkm") AS forest\_percent

FROM forestation

WHERE year = 1990

GROUP BY "Region") sub

ORDER BY forest\_percent

LIMIT 1;

*/\* Which 5 countries saw the largest amount decrease in forest area from 1990 to 2016?*

*What was the difference in forest area for each? \*/*

WITH

tab1 AS(SELECT "Region",

                "Country Name",

                "Forest\_Area"

        FROM forestation

        WHERE year = 1990),

 tab2 AS

        (SELECT "Region",

                "Country Name",

                "Forest\_Area"

        FROM forestation

        WHERE year = 2016)

SELECT tab1."Region",

        tab1."Country Name",

        tab1."Forest\_Area" forest\_1990,

        tab2."Forest\_Area" forest\_2016,

        ROUND(CAST((tab1."Forest\_Area" - tab2."Forest\_Area")AS numeric), 2) AS forest\_area\_difference,

        ROUND(CAST(((tab1."Forest\_Area" - tab2."Forest\_Area")\*100/tab1."Forest\_Area")AS numeric), 2) AS decrease\_percent

FROM tab1

JOIN tab2

ON tab1."Country Name" = tab2."Country Name"

WHERE tab2."Forest\_Area" < tab1."Forest\_Area"

AND tab1."Region" != 'World'

ORDER BY forest\_area\_difference DESC

LIMIT 5;

SELECT f1.country\_name country,

        (f1.forest\_area\_sqkm  - f2.forest\_area\_sqkm)AS forest\_difference

FROM forest\_area f1

JOIN forest\_area f2

ON (f1.year = '2016' AND f2.year = '1990')

AND f1.country\_name = f2.country\_name

ORDER BY forest\_difference DESC;

China *-------- 527229.062*

United States *-- 79200*

SELECT f1.country\_name country,

        100.0 \* (f1.forest\_area\_sqkm  - f2.forest\_area\_sqkm) / f2.forest\_area\_sqkm AS percent\_difference

FROM forest\_area f1

JOIN forest\_area f2

ON (f1.year = '2016' AND f2.year = '1990')

AND f1.country\_name = f2.country\_name

ORDER BY percent\_difference DESC;

Iceland --- 213.664588870028

*/\*Which 5 countries saw the largest percent decrease in forest*

*rea from 1990 to 2016? What was the percent change to 2?*

*decimal places for each?*

*\*/*

WITH

tab1 AS(SELECT "Region",

                "Country Name",

                "Forest\_Area"

        FROM forestation

        WHERE year = 1990),

 tab2 AS

        (SELECT "Region",

                "Country Name",

                "Forest\_Area"

        FROM forestation

        WHERE year = 2016)

SELECT tab1."Region",

        tab1."Country Name",

        tab1."Forest\_Area" forest\_1990,

        tab2."Forest\_Area" forest\_2016,

        ROUND(CAST((tab2."Forest\_Area" - tab1."Forest\_Area")AS numeric), 2) AS forest\_area\_difference,

        ROUND(CAST(((tab2."Forest\_Area" - tab1."Forest\_Area")\*100/tab1."Forest\_Area")AS numeric), 2) AS decrease\_percent

FROM tab1

JOIN tab2

ON tab1."Country Name" = tab2."Country Name"

WHERE tab2."Forest\_Area" < tab1."Forest\_Area"

AND tab1."Region" != 'World'

ORDER BY decrease\_percent DESC

LIMIT 5;

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Region** | **Country Name** | **forest\_1990** | **forest\_2016** | **forest\_area\_difference** | **decrease\_percent** |
| Latin America & Caribbean | Brazil | 5467050 | 4925540 | 541510 | 9.9 |
| East Asia & Pacific | Indonesia | 1185450 | 903256.0156 | 282193.98 | 23.8 |
| East Asia & Pacific | Myanmar | 392180 | 284945.9961 | 107234 | 27.34 |
| Sub-Saharan Africa | Nigeria | 172340 | 65833.99902 | 106506 | 61.8 |
| Sub-Saharan Africa | Tanzania | 559200 | 456880 | 102320 | 18.3 |

*/\*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?*

*\*/*

WITH

tab1 AS(SELECT "Region",

                "Country Name",

                "Forest\_Area"

        FROM forestation

        WHERE year = 1990),

 tab2 AS

        (SELECT "Region",

                "Country Name",

                "Forest\_Area"

        FROM forestation

        WHERE year = 2016)

SELECT tab1."Region",

        tab1."Country Name",

        tab1."Forest\_Area" forest\_1990,

        tab2."Forest\_Area" forest\_2016,

        ROUND(CAST((tab1."Forest\_Area" - tab2."Forest\_Area")AS numeric), 2) AS forest\_area\_difference,

        ROUND(CAST(((tab1."Forest\_Area" - tab2."Forest\_Area")\*100/tab1."Forest\_Area")AS numeric), 2) AS decrease\_percent

FROM tab1

JOIN tab2

ON tab1."Country Name" = tab2."Country Name"

WHERE tab2."Forest\_Area" < tab1."Forest\_Area"

AND tab1."Region" != 'World'

ORDER BY decrease\_percent DESC

LIMIT 5;

*/\*If countries were grouped by percent forestation in quartiles,*

*which group had the most countries in it in 2016? \*/*

WITH tab1 AS

(SELECT \*

FROM forestation

WHERE year = 2016

AND "Region" NOT LIKE 'World'

AND "Forest Percentage" IS NOT NULL),

tab2 AS

(SELECT \*,

CASE

WHEN "Forest Percentage" >= 75 THEN '75 - 100%'

WHEN "Forest Percentage" > 50 AND "Forest Percentage" <= 75 THEN '50-75%'

WHEN "Forest Percentage" > 25 AND "Forest Percentage" <= 50 THEN '25-50%'

ELSE '0-25%'

END AS Quartile

FROM tab1)

SELECT Quartile , COUNT(\*) AS "Number of Countries"

FROM tab2

GROUP BY Quartile;

|  |  |
| --- | --- |
| quartile | Number of Countries |
| 25-50% | 72 |
| 75 - 100% | 9 |
| 0-25% | 85 |
| 50-75% | 38 |

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

SELECT "Country Name",

       "Region",

       "Forest Percentage"

FROM forestation

WHERE "Forest Percentage"> 75

AND "Forest Percentage" IS NOT NULL

AND year = 2016

ORDER BY "Forest Percentage" DESC;

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

SELECT COUNT("Country Name")

FROM forestation

WHERE year = 2016

AND "Forest Percentage" >

        (SELECT "Forest Percentage"

        FROM forestation

        WHERE "Country Name" = 'United States'

        AND year = 2016);