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

The World Bank data reveals a concerning global trend: forest area is steadily declining. Between 1990 and 2016, the world lost approximately 1.32 million square kilometers of forest—an area larger than Peru. This widespread deforestation calls for urgent and targeted action.

Notably, 85 countries fall into the lowest quartile of forestation, with less than 25% of their land covered by forests. Fewer than half of all countries are in the 3rd and 4th quartiles combined, indicating that high forestation levels are becoming increasingly rare.

To address this, we recommend the following actions:

1. **Prioritize High-Risk Countries**: Focus efforts on countries that experienced the greatest forest loss, both in absolute area and in percentage terms. Countries such as Brazil, Indonesia, Myanmar, Tanzania, and Nigeria lost the most forest land in square kilometers. Meanwhile, Togo, Nigeria, Uganda, Mauritania, and Honduras saw the highest percentage declines.
2. **Engage Sub-Saharan Africa**: This region shows a persistent and troubling pattern of deforestation. With four of the top five countries for percent loss located here, Sub-Saharan Africa should be a primary focus for international reforestation initiatives and policy interventions.
3. **Support Sustainable Alternatives**: Offer affected countries viable alternatives to deforestation. This may include economic incentives for forest conservation, sustainable agriculture practices, or afforestation programs. Tailored solutions can help balance development needs with environmental preservation.
4. **Promote Knowledge Sharing**: Countries like China and Iceland have made significant progress in increasing their forest area. Understanding the policies, technologies, and incentives behind these successes could provide valuable guidance for other nations.
5. **Raise Global Awareness**: Forest loss is a global issue with widespread environmental consequences. Increasing awareness and collaboration across borders is essential to reverse the trend and protect remaining forests.

By identifying key areas of concern and supporting evidence-based interventions, we can take meaningful steps toward halting deforestation and promoting global forest recovery.

APPENDIX

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Steps to Complete

    Create a View called “forestation” by joining all three tables - forest\_area,

     land\_area and regions in the workspace.

    The forest\_area and land\_area tables join on both country\_code AND year.

    The regions table joins these based on only country\_code.

    In the ‘forestation’ View, include the following:

        All of the columns of the origin tables

        A new column that provides the percent of the land area that is designated as forest.

    Keep in mind that the column forest\_area\_sqkm in the forest\_area table and the land\_area\_sqmi

    in the land\_area table are in different units (square kilometers and square miles, respectively),

    so an adjustment will need to be made in the calculation you write (1 sq mi = 2.59 sq km).

\*/

CREATE VIEW forestation AS

SELECT f.country\_code AS country\_code, f.country\_name AS country\_name,

f.year AS year, f.forest\_area\_sqkm AS forest\_area\_sqkm,

l.total\_area\_sq\_mi AS total\_area\_sq\_mi, r.region AS region,

r.income\_group AS income\_group,

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

FROM forest\_area AS f, land\_area AS l, regions AS r

WHERE f.country\_code = l.country\_code AND f.year = l.year

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

/\*

1. GLOBAL SITUATION

Instructions:

    Answering these questions will help you add information into the template.

    Use these questions as guides to write SQL queries.

    Use the output from the query to answer these questions.

1a. 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.

1b. What was the total forest area (in sq km) of the world in 2016?

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

\*/

SELECT country\_name, year, forest\_area\_sqkm

FROM forestation

WHERE country\_name='World' AND (YEAR='1990' OR YEAR='2016')

ORDER BY year ASC;

/\* results

country\_name    year      forest\_area\_sqkm

World           1990      41282694.9

World           2016      39958245.9

\*/

/\*

1c. What was the change (in sq km) in the forest area of the world from 1990 to 2016?

\*/

SELECT (t1.forest\_area\_sqkm - t0.forest\_area\_sqkm) AS abs\_change\_sq\_km

FROM forestation AS t1, forestation AS t0

WHERE t1.year = '2016' AND t1.country\_name = 'World'

AND   t0.year = '1990' AND t0.country\_name = 'World';

/\* results

abs\_change\_sq\_km

-1324449

\*/

/\*

1d. What was the percent change in forest area of the world between 1990 and 2016?

\*/

SELECT (((t1.forest\_area\_sqkm / t0.forest\_area\_sqkm)-1)\*100) AS percent\_change\_forestArea

FROM forestation AS t1, forestation AS t0

WHERE t1.year = '2016' AND t1.country\_name = 'World'

AND   t0.year = '1990' AND t0.country\_name = 'World';

/\* results

percent\_change\_forestarea

-3.20824258980245

\*/

/\*

1e. 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\_sq\_mi\*2.59) AS total\_area\_sq\_km

FROM forestation

WHERE year='2016' AND (total\_area\_sq\_mi\*2.59)>1270000 AND (total\_area\_sq\_mi\*2.59)<1324449;

/\* results

country\_name    total\_area\_sq\_km

Peru            1279999.9891

\*/

/\*

2. REGIONAL OUTLOOK

2a. What was the percent forest of the entire world in 2016?

   Which region had the HIGHEST percent forest in 2016,

   and which had the LOWEST, to 2 decimal places?

2b. What was the percent forest of the entire world in 1990?

   Which region had the HIGHEST percent forest in 1990,

   and which had the LOWEST, to 2 decimal places?

2c. Based on the table you created, which regions of the world

    DECREASED in forest area from 1990 to 2016?

\*/

SELECT t0.region, t0.country\_name, t0.forest\_area\_sqkm AS forest\_area\_1990

FROM forestation t0;

SELECT ROUND(CAST((region\_forest\_1990/region\_area\_1990)\*100 AS NUMERIC),2)

AS forest\_cover\_1990,

ROUND(CAST((region\_forest\_2016/region\_area\_2016)\*100 AS NUMERIC),2)

AS forest\_cover\_2016, region

FROM (SELECT SUM(t0.forest\_area\_sqkm) AS region\_forest\_1990,

      SUM (t0.total\_area\_sq\_mi\*2.59) AS region\_area\_1990, t0.region,

      SUM (t1.forest\_area\_sqkm) AS region\_forest\_2016,

      SUM (t1.total\_area\_sq\_mi\*2.59) AS region\_area\_2016

FROM forestation t0, forestation t1

      WHERE t0.year ='1990'

      AND t1.year ='2016'

      AND t0.region = t1.region

GROUP BY t0.region) region\_percent

ORDER BY forest\_cover\_1990 DESC;

/\*

Output

8 results

Download CSV

forest\_cover\_1990   forest\_cover\_2016   region

51.0                46.2                Latin America & Caribbean

37.3                38.0                Europe & Central Asia

35.7                36.0                North America

32.4                31.4                World

30.7                28.8                Sub-Saharan Africa

25.8                26.4                East Asia & Pacific

16.5                17.5                South Asia

1.8                2.1              Middle East & North Africa

\*/

/\*

3. COUNTRY-LEVEL DETAIL

A.  SUCCESS STORIES

\*/

SELECT t1.country\_name, t1.region,

ROUND(CAST(((t1.forest\_area\_sqkm-t0.forest\_area\_sqkm)) AS NUMERIC),2)

AS change\_forestArea\_sqkm

FROM forestation AS t1

JOIN forestation AS t0

ON (t1.year='2016' AND t0.year='1990')

AND t1.country\_code = t0.country\_code

WHERE t1.country\_name !='World'

AND t1.forest\_area\_sqkm !=0 AND t0.forest\_area\_sqkm !=0

ORDER BY change\_forestArea\_sqkm DESC

Limit 5;

/\*

Output

5 results

country\_name             region                     change\_forestarea\_sqkm

China                    East Asia & Pacific          527229.06

United States            North America               79200.00

India                    South Asia                  69213.98

Russian Federation     Europe & Central Asia         59395.00

Vietnam                East Asia & Pacific         55390.00

\*/

/\*

Which 5 countries saw the largest absolute decrease in forest area from 1990 to 2016?

What was the sqkm change for each?

\*/

SELECT t1.country\_name, t1.region,

ROUND(CAST(((t1.forest\_area\_sqkm-t0.forest\_area\_sqkm)) AS NUMERIC),2)

AS change\_forestArea\_sqkm

FROM forestation AS t1

JOIN forestation AS t0

ON (t1.year='2016' AND t0.year='1990')

AND t1.country\_code = t0.country\_code

WHERE t1.country\_name !='World'

ORDER BY change\_forestArea\_sqkm ASC

Limit 5;

/\*

Output

5 results

country\_name    region                       change\_forestarea\_sqkm

Brazil        Latin America & Caribbean    -541510.00

Indonesia       East Asia & Pacific          -282193.98

Myanmar       East Asia & Pacific            -107234.00

Nigeria       Sub-Saharan Africa             -106506.00

Tanzania        Sub-Saharan Africa           -102320.00

\*/

/\*

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?

\*/

SELECT t1.country\_name, t1.region,

ROUND(CAST(((t1.forest\_area\_sqkm/t0.forest\_area\_sqkm-1)\*100) AS NUMERIC),2)

AS percent\_change\_forestArea

FROM forestation AS t1

JOIN forestation AS t0

ON (t1.year='2016' AND t0.year='1990')

AND t1.country\_code = t0.country\_code

ORDER BY percent\_change\_forestArea ASC

Limit 5;

/\*

Output

5 results

country\_name    region                      percent\_change\_forestarea

Togo            Sub-Saharan Africa          -75.45

Nigeria       Sub-Saharan Africa            -61.80

Uganda        Sub-Saharan Africa            -59.13

Mauritania    Sub-Saharan Africa            -46.75

Honduras        Latin America & Caribbean     -45.03

\*/

/\*

Country with largest percent change in forest area from 1990 to 2016

\*/

SELECT t1.country\_name, t1.region,

ROUND(CAST(((t1.forest\_area\_sqkm/(t0.forest\_area\_sqkm+0.01)-1)\*100) AS NUMERIC),2)

AS percent\_change\_forestArea

FROM forestation AS t1

JOIN forestation AS t0

ON (t1.year='2016' AND t0.year='1990')

AND t1.country\_code = t0.country\_code

WHERE t0.forest\_area\_sqkm != 0 AND t1.forest\_area\_sqkm != 0

ORDER BY percent\_change\_forestArea DESC

LIMIT 1;

/\*

Output

1 results

country\_name        region                     percent\_change\_forestarea

Iceland           Europe & Central Asia      213.65

\*/

/\*

c. If countries were grouped by percent forestation in quartiles,

which group had the most countries in it in 2016?

\*/

With tab1 AS

(SELECT country\_name, year,forest\_area\_sqkm, total\_area\_sq\_mi\*2.59

  AS total\_area\_sqkm, percent\_forest

FROM forestation

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

        AND forest\_area\_sqkm !=0 AND total\_area\_sq\_mi!=0)

ORDER BY percent\_forest DESC),

tab2 AS

(SELECT tab1.country\_name, tab1.year, tab1.percent\_forest,

  CASE WHEN tab1.percent\_forest > 75 THEN 4

  WHEN tab1.percent\_forest <= 75 AND tab1.percent\_forest > 50 THEN 3

  WHEN tab1.percent\_forest <= 50 AND tab1.percent\_forest > 25 THEN 2

  ELSE 1

  END AS percentile

  FROM tab1 ORDER BY 4 DESC)

SELECT tab2.percentile, COUNT(tab2.percentile)

FROM tab2

GROUP BY 1

ORDER BY 2 DESC;

/\*

Output

4 results

percentile  count

1             85

2             72

3             38

4              9

\*/

/\*

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

\*/

SELECT country\_name, region, year,forest\_area\_sqkm, total\_area\_sq\_mi\*2.59 AS total\_area\_sqkm,

ROUND(CAST((percent\_forest) AS NUMERIC),2) AS percent

FROM forestation

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

        AND forest\_area\_sqkm !=0 AND total\_area\_sq\_mi!=0)

        AND percent\_forest > 75

ORDER BY percent\_forest DESC;

/\*

Output

9 results

country\_name              region                      year  forest\_area\_sqkm       total\_area\_sqkm     percent

Suriname                  Latin America & Caribbean 2016    153282.002           155999.9994           98.26

Micronesia, Fed. Sts.     East Asia & Pacific         2016  643.0000305          699.9993              91.86

Gabon                     Sub-Saharan Africa          2016  232000               257670.0091           90.04

Seychelles              Sub-Saharan Africa        2016  406.6999817          460.0099              88.41

Palau                     East Asia & Pacific         2016  402.9999924          460.0099              87.61

American Samoa          East Asia & Pacific       2016  175                  199.9998              87.50

Guyana                  Latin America & Caribbean   2016    165160               196849.9974           83.90

Lao PDR                 East Asia & Pacific       2016  189505.8008          230800.0023           82.11

Solomon Islands         East Asia & Pacific       2016  21793.99902          27990.0005          77.86

\*/

/\*

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

\*/

With tab1 AS

(SELECT country\_name, year,forest\_area\_sqkm, total\_area\_sq\_mi\*2.59

  AS total\_area\_sqkm, percent\_forest

  FROM forestation

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

        AND forest\_area\_sqkm !=0 AND total\_area\_sq\_mi!=0)

  ORDER BY percent\_forest DESC)

SELECT COUNT(tab1.country\_name)

FROM tab1

WHERE tab1.percent\_forest > (SELECT tab1.percent\_forest

  FROM tab1

  WHERE tab1.country\_name = 'United States');

/\*

  Output

  1 results

  count

  94

\*/