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 41,282,6945 km2 in 1990. As of 2016, the most recent year for which data was available, that number had fallen to39,958,246 km2, a loss of 1,324,449 km2, or 3.2 %.

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 1,279,999.99 km2).

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 the Middle East and 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 and the Caribbean, with 51 %, and the region with the lowest relative forestation was Middle East and 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 and Caribbean | 51.03 | 46.16 |
| Europe and Central Asia | 37.28 | 38.04 |
| South Asia | 16.51 | 17.51 |
| East Asia & Pacific | 25.78 | 26.36 |
| Sub-Saharan Africa | 30.67 | 28.79 |
| North America | 35.65 | 36.04 |
| 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 and 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 527,229.06 km2. 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 79,200 km2, 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 | 541,510 km2 |
| Indonesia | East Asia & Pacific | 282,193.98 km2 |
| Myanmar | East Asia & Pacific | 107,234 km2 |
| Nigeria | Sub-Saharan Africa | 106,506 km2 |
| Tanzania | Sub-Saharan Africa | 102,320 km2 |

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 | 59.27 |
| Mauritania | Sub-Saharan Africa | 46.75 |
| Honduras | Latin America and 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 Togo, Nigeria, Uganda, and Mauritania. The 5th country on the list is Honduras, which is in the Latin America and 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 |
| 75-100 | 9 |
| 50-75 | 38 |
| 25-50 | 72 |
| 0-25 | 85 |

The largest number of countries in 2016 were found in the last (85) 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 | 98.26 |
| Micronesia, Fed. Sts | East Asia & Pacific | 91.86 |
| Gabon | Sub-Saharan Africa | 90.04 |
| Seychelles | Sub-Saharan Africa | 88.41 |
| Palau | East Asia & Pacific | 87.61 |
| American Samoa | East Asia & Pacific | 87.5 |
| Guyana | Latin America & Caribbean | 83.9 |
| Lao PDR | East Asia & Pacific | 82.11 |
| Solomon Islands | East Asia & Pacific | 77.86 |

4. RECOMMENDATIONS

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

* *What have you learned from the World Bank data?*
* *Which countries should we focus on over others?*

5. APPENDIX: SQL Queries Used

CREATE VIEW forestation AS

SELECT r.country\_name,

f.year,

r.income\_group,

r.region,

l.total\_area\_sq\_mi \* 2.59 AS total\_area\_sqkm,

f.forest\_area\_sqkm,

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

FROM forest\_area AS f

JOIN land\_area AS l ON f.country\_code = l.country\_code AND f.year = l.year

JOIN regions AS r ON f.country\_code = r.country\_code

GROUP BY r.country\_name, f.year, r.income\_group, r.region, l.total\_area\_sq\_mi, f.forest\_area\_sqkm;

**Part 1 — Global Situation**

**a.**What was the total forest area (in sq km) of the world in 1990?

## SELECT ROUND(forest\_area\_sqkm) FROM forestation WHERE year = 1990 AND country\_name = 'World';

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

SELECT ROUND(forest\_area\_sqkm) FROM forestation WHERE year = 2016 AND country\_name = 'World';

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

WITH world\_forest\_area AS ( SELECT (SELECT forest\_area\_sqkm FROM forestation WHERE year = 1990 AND country\_name = 'World') AS forest\_area\_sqkm\_1990, (SELECT forest\_area\_sqkm FROM forestation WHERE year = 2016 AND country\_name = 'World') AS forest\_area\_sqkm\_2016 ) SELECT ROUND(forest\_area\_sqkm\_1990 - forest\_area\_sqkm\_2016) AS forest\_area\_change FROM world\_forest\_area;

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

WITH world\_forest\_area AS ( SELECT ( SELECT SUM(forest\_area\_sqkm) FROM Forestation WHERE YEAR = 1990 AND country\_name = 'World' ) AS total\_forest\_area\_1990, ( SELECT SUM(forest\_area\_sqkm) FROM forestation WHERE YEAR = 2016 AND country\_name = 'World' ) AS total\_forest\_area\_2016 ) SELECT ROUND( ( ( (total\_forest\_area\_1990 - total\_forest\_area\_2016) / total\_forest\_area\_1990 ) \* 100 )::numeric, 1 ) AS percent\_change\_in\_forest\_area FROM world\_forest\_area;

**e.**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?

WITH forest\_change AS ( SELECT country\_name, MAX(CASE WHEN year = 2016 THEN total\_area\_sqkm END) AS total\_area\_2016, (SELECT MAX(forest\_area\_sqkm) FROM forestation WHERE year = 1990 AND country\_name = 'World') AS forest\_area\_1990, (SELECT MAX(forest\_area\_sqkm) FROM forestation WHERE year = 2016 AND country\_name = 'World') AS forest\_area\_2016 FROM forestation GROUP BY country\_name ) SELECT fc.country\_name, fc.total\_area\_2016, fc.total\_area\_2016 - (fc.forest\_area\_1990 - fc.forest\_area\_2016) AS difference FROM forest\_change fc ORDER BY ABS(fc.total\_area\_2016 - (fc.forest\_area\_1990 - fc.forest\_area\_2016)) ASC LIMIT 1;

**Part 2 - Regional Outlook**

1. *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?*

SELECT CAST(SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm) \* 100 AS NUMERIC) AS percent\_forest\_world

FROM forestation

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

*-**Which region had the HIGHEST percent forest in 2016*  
SELECT region, CAST(SUM(forest\_area\_sqkm) \* 100 / SUM(total\_area\_sqkm) AS NUMERIC) AS percent\_forest FROM forestation WHERE year = 2016 GROUP BY region ORDER BY percent\_forest DESC LIMIT 1;

- Which region had the LOWEST percent forest in 2016

SELECT region, ROUND(CAST(SUM(forest\_area\_sqkm) \* 100.0 / SUM(total\_area\_sqkm) AS numeric), 2) AS percent\_forest FROM forestation WHERE year = 2016 GROUP BY region ORDER BY percent\_forest ASC LIMIT 1;

1. *What was the percent forest of the entire world in 1990?*

SELECT forest\_area\_sqkm \* 100/ total\_area\_sqkm AS total\_forest\_percent FROM forestation WHERE year = 1990 AND country\_name = 'World' ;

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

SELECT region, ROUND(SUM(forest\_area\_sqkm) \* 100.0 / SUM(total\_area\_sqkm)) AS percent\_forest FROM forestation WHERE year = 1990 AND region NOT LIKE 'World' GROUP BY region ORDER BY percent\_forest DESC LIMIT 1;

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

SELECT region, ROUND(CAST(SUM(forest\_area\_sqkm) \* 100.0 / SUM(total\_area\_sqkm) AS numeric), 2) AS percent\_forest FROM forestation WHERE year = 1990 AND region NOT LIKE 'World' GROUP BY region ORDER BY percent\_forest ASC LIMIT 1;

1. *Based on the table you created, which regions of the world DECREASED in forest area from 1990 to 2016?*

WITH forest\_change AS ( SELECT region, SUM(CASE WHEN year = 1990 THEN forest\_area\_sqkm ELSE 0 END) AS forest\_sum\_1990, SUM(CASE WHEN year = 2016 THEN forest\_area\_sqkm ELSE 0 END) AS forest\_sum\_2016 FROM forestation WHERE region <> 'World' GROUP BY region ) SELECT region, ((forest\_sum\_2016 - forest\_sum\_1990) \* 100.0 / NULLIF(forest\_sum\_1990, 0)) AS percent\_change FROM forest\_change WHERE forest\_sum\_2016 < forest\_sum\_1990;

**Part 3 - Country-Level Detail**

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 forestation\_data AS ( SELECT region, country\_name, SUM(CASE WHEN year = 1990 THEN forest\_area\_sqkm ELSE 0 END) AS forest\_sum\_1990, SUM(CASE WHEN year = 2016 THEN forest\_area\_sqkm ELSE 0 END) AS forest\_sum\_2016 FROM forestation WHERE region NOT LIKE 'World' GROUP BY region, country\_name ) SELECT fd.region, fd.country\_name, fd.forest\_sum\_1990 AS forest\_1990, fd.forest\_sum\_2016 AS forest\_2016, ROUND(CAST((fd.forest\_sum\_1990 - fd.forest\_sum\_2016) AS numeric), 2) AS difference FROM forestation\_data fd WHERE fd.forest\_sum\_2016 < fd.forest\_sum\_1990 ORDER BY difference DESC LIMIT 5;

1. *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 Forestation\_1990 AS ( SELECT country\_name, (SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm \* 2.59)) \* 100 AS percent\_forestation\_1 FROM forestation WHERE year = 1990 GROUP BY country\_name ), Forestation\_2016 AS ( SELECT country\_name, (SUM(forest\_area\_sqkm) / SUM(total\_area\_sqkm \* 2.59)) \* 100 AS percent\_forestation\_2 FROM forestation WHERE year = 2016 GROUP BY country\_name ) SELECT f.country\_name, ROUND((((f.percent\_forestation\_1 - t.percent\_forestation\_2) / f.percent\_forestation\_1) \* 100)::numeric, 2) AS percent\_change FROM Forestation\_1990 f JOIN Forestation\_2016 t ON f.country\_name = t.country\_name WHERE f.percent\_forestation\_1 IS NOT NULL AND t.percent\_forestation\_2 IS NOT NULL AND f.country\_name != 'World' ORDER BY percent\_change DESC LIMIT 5;

1. *If countries were grouped by percent forestation in quartiles, which group had the most countries in it in 2016?*

WITH forestation\_quartiles AS ( SELECT region, country\_name, CASE WHEN forest\_percent > 75 THEN 'Fourth' WHEN forest\_percent <= 75 AND forest\_percent > 50 THEN 'Third' WHEN forest\_percent <= 50 AND forest\_percent > 25 THEN 'Second' ELSE 'First' END AS quartiles FROM forestation WHERE year = 2016 AND region NOT LIKE 'World' AND forest\_percent IS NOT NULL ) SELECT quartiles, COUNT(\*) AS quartiles\_groups FROM forestation\_quartiles GROUP BY quartiles;

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

SELECT country\_name, region, forest\_percent FROM forestation WHERE year = 2016 AND forest\_percent > 75 ORDER BY forest\_percent DESC;

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

SELECT COUNT(country\_name) FROM forestation f1 WHERE year = 2016 AND forest\_percent > ( SELECT forest\_percent FROM forestation f2 WHERE f2.country\_name = 'United States' AND f2.year = 2016 );