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 41,282,694.9 km² in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39,958,245.9 km², a loss of 1,324,449 km²or 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 1,279,999.99 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 and Caribbean with 46.16% and the region with the lowest relative forestation was 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 Caribbean with 51.03% 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
East Asia and Pacific	25.78%	26.36%
Europe and Central Asia	37.28%	38.04%

Latin America and Caribbean	51.03%	46.16%
Middle East & North Africa	1.78%	2.07%
North America	35.65%	36.04%
South Asia	16.51%	17.51%
Sub-Saharan Africa	30.67%	28.79%

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**

A. 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 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.

B. 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 and Caribbean	-1324449 km²
Indonesia	East Asia and Pacific	-282193.98 km²
Myanmar	East Asia and Pacific	-107234 km²
Nigeria	Sub-Saharan Africa	-106506 km²
Tanzania	Sub-Saharan Africa	-102320 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	-59.13%
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-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.

C. QUARTILES

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

Quartile	Number of Countries
Q1	85
Q2	72
Q3	38
Q4	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
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%

5. RECOMMENDATIONS

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

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

Over 26 years (1990 – 2016) we have lost, in terms of forest area, the equivalent of the whole current total area of Peru, which is a negative result.

Both in 1990 and 2016, the region with the highest relative forestation area was Latin America and Caribbean, whereas the one with the lowest was Middle East and North Africa, although the former decreased in terms of relative forestation area, whilst the latter increased.
Sub-Saharan Africa also decrease, meanwhile all the remaining regions increased. Overall, the global relative forestation area has decreased by about 1%, showing a negative trend.
Country-wise, the one with the highest increase in absolute forest area has been China, followed closely by United States (though in smaller measure). Being large countries, their relative increase is actually very small. From this perspective, Iceland sits at the top, having increased relative forestation area by over 100%.
4 of the top 5 countries who have decrease the most in terms of relative forestation area belong to the Sub-Saharan African region, with Nigeria also being in top 5 countries in terms of absolute forest area loss.
Only a small number of countries shows a forestation area of over 75%, whereas the largest number of countries shows a forestation area of below 25%.

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

It seems we should give priority to the countries who lost the most in terms of relative forestation area. Less green area means less oxygen, less clean air and therefore less wellbeing for the country's population. Nigeria would certainly be at the top of the list, being also in the top 5 for absolute forest area loss.
Brazil and Honduras are also worth considering, both being located in the Latin America and Caribbean region, a possible sign that the region is experiencing a negative trend. It's a well-known fact that Latin America is losing some of its precious green land.

Appendix

```
/* Creating the initial view */

CREATE VIEW forestation AS
SELECT fa.country_code, fa.country_name, fa.year,  CAST ((fa.forest_area_sqkm) AS
numeric), CAST((la.total_area_sq_mi) AS numeric), CAST((la.total_area_sq_mi * 2.59) AS
NUMERIC) as total_area_sqkm, ROUND(CAST((fa.forest_area_sqkm/(la.total_area_sq_mi *
2.59))*100 AS DECIMAL),2) as perc_land_as_forest, re.region, re.income_group
 FROM forest_area fa
 JOIN land_area la
 ON fa.country_code = la.country_code
  AND fa.year = la.year
 JOIN regions re
 ON la.country_code = re.country_code

/* END */
```

```
/* Total global forest area in 1990, 2016 and difference in SQKM and percentage - filtered to
show only "World"

WITH forestation_self_join AS
(SELECT fo1.country_name,
fo1.year,
SUM(fo1.forest_area_sqkm) AS forest_area_sqkm,
SUM(fo1.total_area_sqkm) as total_area_sqkm,
SUM(fo1.perc_land_as_forest) as perc_land_as_forest,
fo2.country_name as fo2_country_name,
fo2.year as fo2_year,
SUM(fo2.forest_area_sqkm) AS fo2_forest_area_sqkm,
SUM(fo2.total_area_sqkm) as fo2_total_area_sqkm,
SUM(fo2.perc_land_as_forest) as fo2_perc_land_as_forest
FROM forestation fo1
JOIN forestation fo2
ON fo1.country_name = fo2.country_name
AND fo2.year > fo1.year
GROUP BY  1, 2, 6, 7
ORDER BY 2 ASC)

SELECT country_name,
year,
forest_area_sqkm,
```

```
total_area_sqkm,
fo2_year,
fo2_forest_area_sqkm,
fo2_total_area_sqkm,
(fo2_forest_area_sqkm - forest_area_sqkm) as change_in_forest_area,
ROUND(((fo2_forest_area_sqkm - forest_area_sqkm)/forest_area_sqkm)*100,2) as
change_in_forest_area_perc
FROM forestation_self_join
WHERE country_name = 'World'AND year = '1990'  AND fo2_year = '2016'

/* END */
```

```
/* Finding country's total area closest to amount of forest area lost between 1990 and 2016 */

SELECT country_name, (total_area_sq_mi*2.59) as total_area
    FROM forestation
    WHERE year = '2016' AND (total_area_sq_mi*2.59) IS NOT NULL AND
(total_area_sq_mi*2.59) <
    (SELECT change_in_forest_area
FROM (SELECT a.country_name, a.year as year1, a.forest_area_sqkm as f_area1, b.year as
year2, b.forest_area_sqkm as f_area2, (a.forest_area_sqkm - b.forest_area_sqkm) as
change_in_forest_area
FROM forestation a
JOIN forestation b
ON a.country_name = b.country_name
AND b.forest_area_sqkm < a.forest_area_sqkm
WHERE a.forest_area_sqkm IS NOT NULL AND a.year = '1990' AND b.year = '2016' AND
a.country_name = 'World') sub1)
ORDER BY 2 DESC
LIMIT 1

/* END */
```

```
/* Create table for Regional Outlook */

CREATE TABLE region_table AS SELECT year, region, SUM(forest_area_sqkm) AS
forest_area_sqkm, SUM(total_area_sq_mi) AS total_area_sq_mi, SUM(total_area_sqkm) AS
total_area_sqkm, ROUND((SUM(forest_area_sqkm)/SUM(total_area_sqkm))*100,2) AS
perc_land_as_forest
FROM forestation
GROUP BY year, region
ORDER BY year, region
```

/* END */

/* Regional Outlook query */

```
WITH region_query AS (SELECT re1.year as re1_year, re1.region as re1_region,
re1.forest_area_sqkm as re1_forest_area_sqkm, re1.total_area_sq_mi as
re1_total_area_sq_mi, re1.total_area_sqkm as re1_total_area_sqkm,  re1.perc_land_as_forest
as re1_perc_land_as_forest,
re2.year as re2_year, re2.region as re2_region, re2.forest_area_sqkm as
re2_forest_area_sqkm, re2.total_area_sq_mi as re2_total_area_sq_mi,
re2.perc_land_as_forest as re2_perc_land_as_forest
FROM region_table re1
JOIN region_table re2
ON re1.region = re2.region
AND re2.year > re1.year
ORDER BY 1, 2, 7 )

SELECT *, (re2_forest_area_sqkm - re1_forest_area_sqkm) AS variance_sqkm,
ROUND(((re2_perc_land_as_forest  - re1_perc_land_as_forest)/re1_perc_land_as_forest),2) as
variance_perc
FROM region_query
```

/* END */

/* COUNTRY - this query shows change by absolute square km forest area and by percentage forest area */

```
SELECT *,ROUND((fo2_forest_area_sqkm - fo1_forest_area_sqkm),2) as variance_sqkm,
ROUND(((fo2_forest_area_sqkm - fo1_forest_area_sqkm)/fo1_forest_area_sqkm)*100, 2) as
variance_perc
FROM
(SELECT fo1.region, fo1.country_name as fo1_country_name, fo1.year as fo1_year,
fo1.forest_area_sqkm as fo1_forest_area_sqkm, fo1.total_area_sqkm as fo1_total_area_sqkm,
fo1.perc_land_as_forest as fo1_perc_land_as_forest,
fo2.year as fo2_year, fo2.forest_area_sqkm as fo2_forest_area_sqkm, fo2.total_area_sqkm as
fo2_total_area_sqkm, fo2.perc_land_as_forest as fo2_perc_land_as_forest
FROM forestation fo1
JOIN forestation fo2
ON fo1.country_name = fo2.country_name
AND fo2.year > fo1.year
```

```
WHERE fo1.year = '1990' AND fo2.year = '2016' AND fo1.forest_area_sqkm IS NOT NULL )
sub1

/* END */
```

```
/* COUNTRY - this is to show the different quartiles, using CASE statement */

SELECT year, region, country_name, perc_land_as_forest,
CASE WHEN perc_land_as_forest <= 25.00 THEN 'Q1'
    WHEN perc_land_as_forest <= 50.00 THEN 'Q2'
    WHEN perc_Land_as_forest <= 75.00 THEN 'Q3'
    WHEN perc_land_as_forest <= 100.00 THEN 'Q4' END
    AS quartile
FROM forestation
WHERE year = '2016' AND perc_Land_as_forest IS NOT NULL AND country_name != 'World'
ORDER by perc_land_as_forest DESC

/*END*/
```

```
/* This is to do a count of how many countries per quartile */

SELECT quartile, COUNT(*)

FROM (SELECT year, region, country_name, perc_land_as_forest,
CASE WHEN perc_land_as_forest <= 25.00 THEN 'Q1'
    WHEN perc_land_as_forest <= 50.00 THEN 'Q2'
    WHEN perc_Land_as_forest <= 75.00 THEN 'Q3'
    WHEN perc_land_as_forest <= 100.00 THEN 'Q4' END
    AS quartile
FROM forestation
WHERE year = '2016' AND perc_Land_as_forest IS NOT NULL AND country_name != 'World'
ORDER by perc_land_as_forest DESC) sub1
GROUP BY quartile
ORDER BY 1

/* END */
```