# 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 km², or 3.20824258980244%.

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 1,279,999.9891 km²).

## 2. **REGIONAL OUTLOOK**

In 2016, the percent of the total land area of the world designated as forest was 31.3755709643095%. The region with the highest relative forestation was Latin America & Caribbean, with 46.1620721996047%, and the region with the lowest relative forestation was Middle East & North Africa, with 2.06826486871501% forestation.

In 1990, the percent of the total land area of the world designated as forest was 32.4222035575689%. The region with the highest relative forestation was Latin America & Caribbean with 51.0299798667514%, and the region with the lowest relative forestation was Middle East & North Africa, with 1.77524062469353% 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% |
| Europe & Central Asia | 37.2839398564019% | 38.0414216032517% |
| North America | 35.6511790009015% | 36.0393609681438% |
| World | 32.4222035575689% | 31.3755709643095% |
| Sub-Saharan Africa | 30.6741454610006% | 28.7881883550464% |
| East Asia & Pacific | 25.7760953973175% | 26.3586765000485% |
| South Asia | 16.510767001421% | 17.5058634081534% |
| Middle East & North Africa | 1.77524062469353% | 2.06826486871501% |

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Latin America & Caribbean (dropped from 51.0299798667514% to 46.1620721996047%) and Sub-Saharan Africa (30.6741454610006% to 28.7881883550464%). 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 32.4222035575689% to 31.3755709643095%.

# 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 527,229.062 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 the 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% 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 & Caribbean | 541,510 km² |
| Indonesia | East Asia & Pacific | 282,193.9844 km² |
| Myanmar | East Asia & Pacific | 107,234.0039 km² |
| Nigeria | Sub-Saharan Africa | 106,506.00098 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 | 75.4452559270073% |
| Nigeria | Sub-Saharan Africa | 61.7999309388418% |
| Uganda | Sub-Saharan Africa | 59.1286034729531% |
| Mauritania | Sub-Saharan Africa | 46.7469879518072% |
| Honduras | Latin America & Caribbean | 45.0344149459194% |

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 |
|---|---|
| Q4 | 9 |
| Q3 | 38 |
| Q2 | 73 |
| Q1 | 85 |

The largest number of countries in 2016 were found in the first 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 | 98.2576939676578 |
| Micronesia, Fed. Sts. | East Asia & Pacific | 91.8572390715248 |
| Gabon | Sub-Saharan Africa | 90.0376418700565 |
| Seychelles | Sub-Saharan Africa | 88.4111367385789 |
| Palau | East Asia & Pacific | 87.6068085491204 |
| American Samoa | East Asia & Pacific | 87.5000875000875 |
| Guyana | Latin America & Caribbean | 83.9014489110682 |
| Lao PDR | East Asia & Pacific | 82.1082317640861 |
| Solomon Islands | East Asia & Pacific | 77.8635177945066 |

# 4. RECOMMENDATIONS

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

- *What have you learned from the World Bank data?*
    - **I was surprised to learn that many regions have actually increased in forestation between 1990 and 2016, however the world as a whole has decreased in total forestation due to the fact that some regions have actually decreased. These regions were Sub-Saharan Africa and Latin America & Caribbean. This is in large part due to the exploitation of Africa's natural resources by global superpowers, as well as the destruction of the Amazon.**
- *Which countries should we focus on over others?*
    - **I think Brazil really needs to be the focus, because it has the highest decrease in forest area, which is mostly the Amazon. The Amazon is the most biodiverse place on the planet and must be protected. We should also focus on the African countries suffering from deforestation as a result of their exploitation.**

# APPENDIX

**1.**

```
CREATE VIEW forestation
AS
SELECT f.country_name, f.year, f.forest_area_sqkm,
      (l.total_area_sq_mi * 2.59) AS total_area_sq_km,
      r.region, r.income_group,
      (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59)) * 100 AS perc_forest
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 = f.country_code

SELECT SUM(forest_area_sqkm)
FROM forestation
WHERE year = 1990
AND region = 'World';

SELECT SUM(forest_area_sqkm)
FROM forestation
WHERE year = 2016
AND region = 'World';

SELECT (
    (SELECT SUM(forest_area_sqkm)
                FROM forestation
                WHERE YEAR = 1990
                AND region = 'World') -
                (SELECT SUM(forest_area_sqkm)
                FROM forestation
                WHERE YEAR = 2016
                AND region = 'World')
                ) AS difference
FROM forestation
LIMIT 1;
```

```
SELECT (((
    (SELECT SUM(forest_area_sqkm)
          FROM forestation
          WHERE YEAR = 1990
     AND region = 'World') -
                 (SELECT SUM(forest_area_sqkm)
                  FROM forestation
                 WHERE YEAR = 2016
                 AND region = 'World'))/(
    (SELECT SUM(forest_area_sqkm)
                 FROM forestation
                 WHERE YEAR = 1990
                 AND region = 'World'))) * 100) AS perc_diff
FROM forestation
LIMIT 1;

SELECT country_name, total_area_sq_km
FROM forestation
WHERE year = 2016
AND total_area_sq_km < (
                 (SELECT SUM(forest_area_sqkm)
                 FROM forestation
                 WHERE YEAR = 1990
                 AND region = 'World') -
                 (SELECT SUM(forest_area_sqkm)
                 FROM forestation
                 WHERE YEAR = 2016
                 AND region = 'World'))
ORDER BY 2 DESC
LIMIT 1;
```

**2**

```
SELECT (
	((SELECT SUM(forest_area_sqkm)
	FROM forestation
	WHERE year = 2016
	AND region = 'World')/ (
		SELECT SUM(total_area_sq_km)
		FROM forestation
		WHERE year = 2016
		AND region = 'World')) * 100) perc_forest;

SELECT region, ((SUM(forest_area_sqkm)/SUM(total_area_sq_km)) * 100) perc_forest
FROM forestation
WHERE year = 2016
AND region != 'World'
GROUP BY 1
ORDER BY 2 DESC
LIMIT 1;


SELECT region, ((SUM(forest_area_sqkm)/SUM(total_area_sq_km)) * 100) perc_forest
FROM forestation
WHERE year = 2016
AND region != 'World'
GROUP BY 1
ORDER BY 2
LIMIT 1;

SELECT (
	((SELECT SUM(forest_area_sqkm)
	FROM forestation
	WHERE year = 1990
	AND region = 'World')/ (
		SELECT SUM(total_area_sq_km)
		FROM forestation
		WHERE year = 1990
		AND region = 'World')) * 100) perc_forest;

SELECT region, ((SUM(forest_area_sqkm)/SUM(total_area_sq_km)) * 100) perc_forest
FROM forestation
WHERE year = 1990
AND region != 'World'
GROUP BY 1
ORDER BY 2 DESC
LIMIT 1;
```

```
SELECT region, ((SUM(forest_area_sqkm)/SUM(total_area_sq_km)) * 100) perc_forest
FROM forestation
WHERE year = 1990
AND region != 'World'
GROUP BY 1
ORDER BY 2
LIMIT 1;

SELECT region, ((SUM(forest_area_sqkm)/SUM(total_area_sq_km)) * 100) perc_forest
FROM forestation
WHERE year = 1990
AND region != 'World'
GROUP BY 1
ORDER BY 2 DESC;

SELECT region, ((SUM(forest_area_sqkm)/SUM(total_area_sq_km)) * 100) perc_forest
FROM forestation
WHERE year = 2016
AND region != 'World'
GROUP BY 1
ORDER BY 2 DESC;

WITH t1 AS
(SELECT region, ((SUM(forest_area_sqkm)/SUM(total_area_sq_km)) * 100) perc_forest
FROM forestation
WHERE year = 1990
AND region != 'World'
GROUP BY 1),
t2 AS
(SELECT region, ((SUM(forest_area_sqkm)/SUM(total_area_sq_km)) * 100) perc_forest
FROM forestation
WHERE year = 2016
AND region != 'World'
GROUP BY 1)
SELECT t1.region, t1.perc_forest perc_forest_1990, t2.perc_forest perc_forest_2016
FROM t1
JOIN t2
ON t1.region = t2.region
WHERE t2.perc_forest < t1.perc_forest;
```

```
WITH t1 AS
(SELECT region, ((SUM(forest_area_sqkm)/SUM(total_area_sq_km)) * 100) perc_forest
FROM forestation
WHERE year = 1990
AND region = 'World'
GROUP BY 1),
t2 AS
(SELECT region, ((SUM(forest_area_sqkm)/SUM(total_area_sq_km)) * 100) perc_forest
FROM forestation
WHERE year = 2016
AND region = 'World'
GROUP BY 1)
SELECT t1.region, t1.perc_forest perc_forest_1990, t2.perc_forest perc_forest_2016
FROM t1
JOIN t2
ON t1.region = t2.region;
```

**3**

```
WITH t1 AS
 (SELECT country_name,
 SUM(forest_area_sqkm) forest_area
 FROM forestation
 WHERE YEAR = 1990
 GROUP BY 1),
 t2 AS
 (SELECT country_name,
 SUM(forest_area_sqkm) forest_area
 FROM forestation
 WHERE YEAR = 2016
 GROUP BY 1)
SELECT t2.country_name,
 (t2.forest_area - t1.forest_area) forest_area_diff
FROM t1
JOIN t2
ON t1.country_name = t2.country_name
WHERE t1.forest_area IS NOT NULL
AND t2.forest_area IS NOT NULL
ORDER BY 2 DESC
LIMIT 2;
```

```
WITH t1 AS
 (SELECT country_name,
 SUM(forest_area_sqkm) forest_area
 FROM forestation
 WHERE YEAR = 1990
 GROUP BY 1),
 t2 AS
 (SELECT country_name,
 SUM(forest_area_sqkm) forest_area
 FROM forestation
 WHERE YEAR = 2016
 GROUP BY 1)
SELECT t2.country_name,
 (((t2.forest_area - t1.forest_area)/t1.forest_area) * 100) perc_diff
FROM t1
JOIN t2
ON t1.country_name = t2.country_name
WHERE t1.forest_area IS NOT NULL
AND t2.forest_area IS NOT NULL
AND t2.country_name != 'World'
ORDER BY 2 DESC
LIMIT 1;

WITH t1 AS
 (SELECT country_name,
 SUM(forest_area_sqkm) forest_area
 FROM forestation
 WHERE YEAR = 1990
 GROUP BY 1),
 t2 AS
 (SELECT country_name, region,
 SUM(forest_area_sqkm) forest_area
 FROM forestation
 WHERE YEAR = 2016
 GROUP BY 1,2)
SELECT t2.country_name, t2.region,
 (t2.forest_area - t1.forest_area) forest_area_diff
FROM t1
JOIN t2
ON t1.country_name = t2.country_name
WHERE t1.forest_area IS NOT NULL
AND t2.forest_area IS NOT NULL
AND t2.country_name != 'World'
ORDER BY 3
LIMIT 5;
```

```
WITH t1 AS
   (SELECT country_name, year,
   ((SUM(forest_area_sqkm)/SUM(total_area_sq_km)) * 100) forest_area
   FROM forestation
   WHERE YEAR = 2016
   GROUP BY 1,2)
  SELECT DISTINCT(quartile),
  COUNT(country_name) OVER (PARTITION BY quartile)
  FROM
   (SELECT country_name,
   CASE WHEN forest_area < 25 THEN 'Q1'
   WHEN forest_area >= 25
   AND forest_area < 50 THEN 'Q2'
   WHEN forest_area >= 50
   AND forest_area < 75 THEN 'Q3'
   ELSE 'Q4'
   END AS quartile
   FROM t1
   WHERE forest_area IS NOT NULL
   AND YEAR = 2016
   ORDER BY 2 DESC) sub

SELECT country_name, region,
     ((SUM(forest_area_sqkm)/SUM(total_area_sq_km)) * 100) forest_area
FROM forestation
WHERE year = 2016
AND forest_area IS NOT NULL
AND forest_area > 75
ORDER BY 3;
```