# 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 km^2 in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39958245.9 km^2 , a loss of 1324449 km^2 , 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 1279999.9 km^2).

## 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 East Asia & Pacific, with 50.09%, and the region with the lowest relative forestation was Middle East & North Africa, with 3.19% 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 East Asia & Pacific, with 47.38%, and the region with the lowest relative forestation was Middle East & North Africa, with 2.69% forestation.

Table 2.1: Percent Forest Area by Region, 1990 & 2016:

| Region | 1990 Forest Percentage | 2016 Forest Percentage |
|---|---|---|
| East Asia & Pacific | 47.38 | 50.09 |
| Europe & Central Asia | 26.33 | 28.31 |
| Latin America & Caribbean | 43.34 | 41.64 |
| Middle East & North Africa | 2.69 | 3.19 |
| North America | 29.95 | 30.20 |
| South Asia | 20.68 | 21.56 |
| Sub-Saharan Africa | 35.26 | 31.28 |
| World | 32.42 | 31.38 |

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Sub-Saharan Africa (dropped from 35.26% to 31.28%) and Latin America & Caribbean (43.34% to 41.64%). 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 527229.06 km^2. 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 km^2, 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 0.68% 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 | 541510 |
| Indonesia | East Asia & Pacific | 282193 |
| 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 |
| 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 4 of the top 5 countries on the list are in the region of Sub-Saharan Africa. The countries are Togo, Nigeria, Uganda and Maurtania. 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 6 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 |
|---|---|
| 1 | 85 |
| 2 | 72 |
| 3 | 38 |
| 4 | 9 |

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 | 98.26 |
| 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 | 87.50 |
| Guyana | Latin America & Caribbean | 83.90 |
| Lao PDR | East Asia & Pacific | 82.11 |
| Solomon Islands | East Asia & Pacific | 77.86 |

# 4. RECOMMENDATIONS

The world bank data was clean and detailed which aided in the presentation of the following report. It has taught us which countries are succeeding and which are not. China is an example of a country fighting deforestation with an incredible amount of forest area added between 1990 and 2016. More high income countries should follow China's lead.

Countries should be grouped together to focus our analysis. There are small island countries which will have a disproportionate percent increase/decrease in area designated as forest because they have small land area. Furthermore, large countries with high income should be focused on because they have the means to decrease their deforestation. By grouping countries together we can determine how to best tackle deforestation in each group.

# 5. Appendix: SQL queries used

```
##############################################################################
####
# Creating View
##############################################################################
####

CREATE VIEW forestation AS (
SELECT l.country_code,
      l.country_name,
      l.year,
      l.total_area_sq_mi * 2.59 AS total_area_sqkm,
      f.forest_area_sqkm AS forest_area_sqkm,
      r.region AS region,
      (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS percent_forested,
      forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY l.country_name
ORDER BY l.year) AS forest_area_lost,
      ((LAG(forest_area_sqkm) OVER(PARTITION BY l.country_name ORDER BY l.year) -
(forest_area_sqkm))/LAG(forest_area_sqkm) OVER(PARTITION BY l.country_name ORDER
BY l.year))*100 percent_forest_lost
FROM land_area l
JOIN forest_area f
ON l.country_code = f.country_code AND l.year = f.year
JOIN regions r
ON l.country_code = r.country_code
WHERE l.year = '1990' OR l.year = '2016'
ORDER BY 2, 3)
```

```
################################################################################
####
# Part 1
################################################################################
####

'''
a. 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 r.region, f.year, f.forest_area_sqkm
FROM regions r
JOIN forest_area f
ON r.country_code = f.country_code
WHERE r.region = 'World' AND f.year = '1990'

"""
b. 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 r.region, f.year, f.forest_area_sqkm
FROM regions r
JOIN forest_area f
ON r.country_code = f.country_code
WHERE r.region = 'World' AND f.year = '2016'

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

WITH table1 AS (SELECT r.region, f.year, f.forest_area_sqkm  area_1990
            FROM regions r
            JOIN forest_area f
            ON r.country_code = f.country_code
            WHERE r.region = 'World' AND f.year = '1990'),

          table2 AS (SELECT r.region, f.year, f.forest_area_sqkm area_2016
            FROM regions r
            JOIN forest_area f
            ON r.country_code = f.country_code
            WHERE r.region = 'World' AND f.year = '2016')
```

```
SELECT (table1.area_1990 - table2.area_2016) AS forest_loss_1990_to_2016
FROM table1
JOIN table2
ON table1.region = table2.region

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

WITH table1 AS (SELECT r.region, f.year, f.forest_area_sqkm  area_1990
            FROM regions r
            JOIN forest_area f
            ON r.country_code = f.country_code
            WHERE r.region = 'World' AND f.year = '1990'),

          table2 AS (SELECT r.region, f.year, f.forest_area_sqkm area_2016
            FROM regions r
            JOIN forest_area f
            ON r.country_code = f.country_code
            WHERE r.region = 'World' AND f.year = '2016')

SELECT (100-((table2.area_2016 / table1.area_1990)*100)) AS forest_loss_1990_to_2016
FROM table1
JOIN table2
ON table1.region = table2.region

"""
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?
"""
# tried this method and it didnt work
WITH table1 AS (SELECT r.country_code, r.region, f.year, f.forest_area_sqkm  area_1990
            FROM regions r
            JOIN forest_area f
            ON r.country_code = f.country_code
            WHERE r.region = 'World' AND f.year = '1990'),

          table2 AS (SELECT r.country_code, r.region, f.year, f.forest_area_sqkm area_2016
            FROM regions r
            JOIN forest_area f
            ON r.country_code = f.country_code
            WHERE r.region = 'World' AND f.year = '2016')
```

```
SELECT DISTINCT l.country_name, l.total_area_sq_mi*2.59 total_area_sqkm,
(table1.area_1990 - table2.area_2016) AS forest_loss_1990_to_2016
FROM land_area l
JOIN table1
ON l.country_code = table1.country_code
JOIN table2
ON l.country_code = table2.country_code
WHERE l.total_area_sq_mi*2.59 >= table1.area_1990 - table2.area_2016
ORDER BY 2

# less than mongolia
SELECT DISTINCT l.country_name, l.total_area_sq_mi*2.59 total_area_sqkm
FROM land_area l
WHERE l.total_area_sq_mi*2.59 >= 1300000
ORDER BY 2

# greater than peru
SELECT DISTINCT l.country_name, l.total_area_sq_mi*2.59 total_area_sqkm
FROM land_area l
WHERE l.total_area_sq_mi*2.59 <= 1300000
ORDER BY 2 DESC

##############################################################################
####
# Part 2
##############################################################################
####

'''
a. 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?
'''

# percent forestation of the world in 2016

WITH table1 AS (SELECT l.country_code,
                l.country_name,
                l.year,
                l.total_area_sq_mi * 2.56 AS total_area_sqkm,
                f.forest_area_sqkm forest_area_sqkm,
                r.region region,
                (f.forest_area_sqkm/(l.total_area_sq_mi * 2.56))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost
```

```
            FROM land_area l
            JOIN forest_area f
            ON l.country_code = f.country_code AND l.year = f.year
            JOIN regions r
            ON l.country_code = r.country_code
            WHERE l.year = '1990' OR l.year = '2016'
            ORDER BY 2, 3)

SELECT percent_forested
FROM table1
WHERE year = '2016' AND country_name = 'World'

# highest forested region

WITH table1 AS (SELECT l.country_code,
                    l.country_name,
                    l.year,
                    l.total_area_sq_mi * 2.59 AS total_area_sqkm,
                    f.forest_area_sqkm forest_area_sqkm,
                    r.region region,
                    (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS percent_forested,
                    forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost
            FROM land_area l
            JOIN forest_area f
            ON l.country_code = f.country_code AND l.year = f.year
            JOIN regions r
            ON l.country_code = r.country_code
            WHERE l.year = '1990' OR l.year = '2016'
            ORDER BY 2, 3)

SELECT region, percent_forested
FROM table1
WHERE percent_forested = (WITH table1 AS (SELECT l.country_code,
                                    l.country_name,
                                    l.year,
                                    l.total_area_sq_mi * 2.59 AS total_area_sqkm,
                                    f.forest_area_sqkm forest_area_sqkm,
                                    r.region region,
                                    (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS
percent_forested,
                                    forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION
BY l.country_name ORDER BY l.year) AS forest_area_lost
                                FROM land_area l
```

```
                                JOIN forest_area f
                                ON l.country_code = f.country_code AND l.year = f.year
                                JOIN regions r
                                ON l.country_code = r.country_code
                                WHERE l.year = '1990' OR l.year = '2016'
                                ORDER BY 2, 3)

                        SELECT MAX(percent_forested)
                        FROM table1
                        WHERE year = '2016')

# least forested region

WITH table1 AS (SELECT l.country_code,
                        l.country_name,
                        l.year,
                        l.total_area_sq_mi * 2.59 AS total_area_sqkm,
                        f.forest_area_sqkm forest_area_sqkm,
                        r.region region,
                        (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS percent_forested,
                        forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost
                FROM land_area l
                JOIN forest_area f
                ON l.country_code = f.country_code AND l.year = f.year
                JOIN regions r
                ON l.country_code = r.country_code
                WHERE l.year = '1990' OR l.year = '2016'
                ORDER BY 2, 3)

SELECT region, percent_forested
FROM table1
WHERE percent_forested = (WITH table1 AS (SELECT l.country_code,
                                        l.country_name,
                                        l.year,
                                        l.total_area_sq_mi * 2.59 AS total_area_sqkm,
                                        f.forest_area_sqkm forest_area_sqkm,
                                        r.region region,
                                        (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS
percent_forested,
                                        forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION
BY l.country_name ORDER BY l.year) AS forest_area_lost
                                FROM land_area l
                                JOIN forest_area f
```

```
                    ON l.country_code = f.country_code AND l.year = f.year
                    JOIN regions r
                    ON l.country_code = r.country_code
                    WHERE l.year = '1990' OR l.year = '2016'
                    ORDER BY 2, 3)

                SELECT MIN(percent_forested)
                FROM table1
                WHERE year = '2016')

'''
b. 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?
'''

# percent forestation of the world in 1990

WITH table1 AS (SELECT l.country_code,
                l.country_name,
                l.year,
                l.total_area_sq_mi * 2.56 AS total_area_sqkm,
                f.forest_area_sqkm forest_area_sqkm,
                r.region region,
                (f.forest_area_sqkm/(l.total_area_sq_mi * 2.56))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost
            FROM land_area l
            JOIN forest_area f
            ON l.country_code = f.country_code AND l.year = f.year
            JOIN regions r
            ON l.country_code = r.country_code
            WHERE l.year = '1990' OR l.year = '2016'
            ORDER BY 2, 3)

SELECT percent_forested
FROM table1
WHERE year = '1990' AND country_name = 'World'

# regional percent forested

WITH table1 AS (SELECT l.country_code,
                l.country_name,
                l.year,
                l.total_area_sq_mi * 2.59 AS total_area_sqkm,
```

```
                f.forest_area_sqkm forest_area_sqkm,
                r.region region,
                (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost
        FROM land_area l
        JOIN forest_area f
        ON l.country_code = f.country_code AND l.year = f.year
        JOIN regions r
        ON l.country_code = r.country_code
        WHERE l.year = '1990' OR l.year = '2016'
        ORDER BY 2, 3)

SELECT region, year, AVG(percent_forested) region_percent_forested
FROM table1
GROUP BY 1, 2
ORDER BY 2, 1

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

# regional percent forest per year

WITH table1 AS (SELECT l.country_code,
                l.country_name,
                l.year,
                l.total_area_sq_mi * 2.59 AS total_area_sqkm,
                f.forest_area_sqkm forest_area_sqkm,
                r.region region,
                (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost
        FROM land_area l
        JOIN forest_area f
        ON l.country_code = f.country_code AND l.year = f.year
        JOIN regions r
        ON l.country_code = r.country_code
        WHERE l.year = '1990' OR l.year = '2016'
        ORDER BY 2, 3)

SELECT region, year, AVG(percent_forested) region_percent_forested
FROM table1
```

```
GROUP BY 1, 2
ORDER BY 2, 1

# regional forest area lost

WITH table1 AS (SELECT l.country_code,
                l.country_name,
                l.year,
                l.total_area_sq_mi * 2.59 AS total_area_sqkm,
                f.forest_area_sqkm forest_area_sqkm,
                r.region region,
                (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost
            FROM land_area l
            JOIN forest_area f
            ON l.country_code = f.country_code AND l.year = f.year
            JOIN regions r
            ON l.country_code = r.country_code
            WHERE l.year = '1990' OR l.year = '2016'
            ORDER BY 2, 3)

SELECT region, SUM(forest_area_lost)
FROM table1
GROUP BY 1
ORDER BY 1

# regional forest lost in 1990 and 2016 for sub saharan africa

WITH table1 AS (SELECT l.country_code,
                l.country_name,
                l.year,
                l.total_area_sq_mi * 2.59 AS total_area_sqkm,
                f.forest_area_sqkm forest_area_sqkm,
                r.region region,
                (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost
            FROM land_area l
            JOIN forest_area f
            ON l.country_code = f.country_code AND l.year = f.year
            JOIN regions r
            ON l.country_code = r.country_code
            WHERE l.year = '1990' OR l.year = '2016'
```

```
        ORDER BY 2, 3)

SELECT region, year, AVG(percent_forested) region_percent_forested
FROM table1
WHERE region = 'Sub-Saharan Africa'
GROUP BY 1,2
ORDER BY 1

# regional forest lost in 1990 and 2016 for latin america and carribbean

WITH table1 AS (SELECT l.country_code,
                l.country_name,
                l.year,
                l.total_area_sq_mi * 2.59 AS total_area_sqkm,
                f.forest_area_sqkm forest_area_sqkm,
                r.region region,
                (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost
        FROM land_area l
        JOIN forest_area f
        ON l.country_code = f.country_code AND l.year = f.year
        JOIN regions r
        ON l.country_code = r.country_code
        WHERE l.year = '1990' OR l.year = '2016'
        ORDER BY 2, 3)

SELECT region, year, AVG(percent_forested) region_percent_forested
FROM table1
WHERE region = 'Latin America & Caribbean'
GROUP BY 1,2
ORDER BY 1

##########################################################################
####
# Part 3
##########################################################################
####

'''
a. Which 5 countries saw the largest amount decrease in forest area from 1990
to 2016? What was the difference in forest area for each?
'''
```

```
# 5 countries with largest decrease in forest area from 1990 to 2016

WITH table1 AS (SELECT l.country_code,
                l.country_name,
                l.year,
                l.total_area_sq_mi * 2.56 AS total_area_sqkm,
                f.forest_area_sqkm forest_area_sqkm,
                r.region region,
                (f.forest_area_sqkm/(l.total_area_sq_mi * 2.56))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost
            FROM land_area l
            JOIN forest_area f
            ON l.country_code = f.country_code AND l.year = f.year
            JOIN regions r
            ON l.country_code = r.country_code
            WHERE l.year = '1990' OR l.year = '2016'
            ORDER BY 2, 3)

SELECT country_name, region, SUM(forest_area_lost)
FROM table1
WHERE country_name != 'World'
GROUP BY 1, 2
ORDER BY 3 ASC
LIMIT  5

'''
b. 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?
'''

# top 5 countries with largest percent decrease in forest from 1990 to 2016

WITH table1 AS (SELECT l.country_code,
                l.country_name,
                l.year,
                l.total_area_sq_mi * 2.59 AS total_area_sqkm,
                f.forest_area_sqkm AS forest_area_sqkm,
                r.region AS region,
                (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost,
```

```
                ((LAG(forest_area_sqkm) OVER(PARTITION BY l.country_name ORDER BY
l.year) - (forest_area_sqkm))/LAG(forest_area_sqkm) OVER(PARTITION BY l.country_name
ORDER BY l.year))*100 percent_forest_lost
            FROM land_area l
            JOIN forest_area f
            ON l.country_code = f.country_code AND l.year = f.year
            JOIN regions r
            ON l.country_code = r.country_code
            WHERE l.year = '1990' OR l.year = '2016'
            ORDER BY 2, 3)

SELECT country_name, region, percent_forest_lost, percent_forest_lost2
FROM table1
WHERE country_name != 'World'
ORDER BY 3
LIMIT 5

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

WITH table1 AS (SELECT l.country_code,
                l.country_name,
                l.year,
                l.total_area_sq_mi * 2.59 AS total_area_sqkm,
                f.forest_area_sqkm AS forest_area_sqkm,
                r.region AS region,
                (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost,
                ((LAG(forest_area_sqkm) OVER(PARTITION BY l.country_name ORDER BY
l.year) - (forest_area_sqkm))/LAG(forest_area_sqkm) OVER(PARTITION BY l.country_name
ORDER BY l.year))*100 percent_forest_lost
            FROM land_area l
            JOIN forest_area f
            ON l.country_code = f.country_code AND l.year = f.year
            JOIN regions r
            ON l.country_code = r.country_code
            WHERE l.year = '1990' OR l.year = '2016'
            ORDER BY 2, 3)

SELECT COUNT(*), CASE WHEN percent_forested >= 0 AND percent_forested <=25 THEN 1
                WHEN percent_forested > 25 AND percent_forested <=50 THEN 2
```

```
                WHEN percent_forested > 50 AND percent_forested <=75 THEN 3
                WHEN percent_forested > 75 AND percent_forested <=100 THEN 4
                ELSE NULL END AS quartile
FROM table1
WHERE country_name != 'World' AND year = 2016
GROUP BY 2


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

SELECT country_name, region, percent_forested
FROM(
WITH table1 AS (SELECT l.country_code,
                l.country_name,
                l.year,
                l.total_area_sq_mi * 2.59 AS total_area_sqkm,
                f.forest_area_sqkm AS forest_area_sqkm,
                r.region AS region,
                (f.forest_area_sqkm/(l.total_area_sq_mi * 2.59))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost,
                ((LAG(forest_area_sqkm) OVER(PARTITION BY l.country_name ORDER BY
l.year) - (forest_area_sqkm))/LAG(forest_area_sqkm) OVER(PARTITION BY l.country_name
ORDER BY l.year))*100 percent_forest_lost
            FROM land_area l
            JOIN forest_area f
            ON l.country_code = f.country_code AND l.year = f.year
            JOIN regions r
            ON l.country_code = r.country_code
            WHERE l.year = '1990' OR l.year = '2016'
            ORDER BY 2, 3)

SELECT country_name, region, percent_forested, CASE WHEN percent_forested <= 25 THEN
1
                WHEN percent_forested > 25 AND percent_forested <=50 THEN 2
                WHEN percent_forested > 50 AND percent_forested <=75 THEN 3
                WHEN percent_forested > 75 AND percent_forested <=100 THEN 4
                ELSE NULL END AS quartile
FROM table1
WHERE country_name != 'World' AND year = 2016)t1
WHERE quartile = 4
```

```
ORDER BY 3 DESC

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

# number of countries with percent forestation higher than the US

WITH table1 AS (SELECT l.country_code,
                l.country_name,
                l.year,
                l.total_area_sq_mi * 2.56 AS total_area_sqkm,
                f.forest_area_sqkm AS forest_area_sqkm,
                r.region AS region,
                (f.forest_area_sqkm/(l.total_area_sq_mi * 2.56))*100 AS percent_forested,
                forest_area_sqkm - LAG(forest_area_sqkm) OVER(PARTITION BY
l.country_name ORDER BY l.year) AS forest_area_lost,
                ((LAG(forest_area_sqkm) OVER(PARTITION BY l.country_name ORDER BY
l.year) - (forest_area_sqkm))/LAG(forest_area_sqkm) OVER(PARTITION BY l.country_name
ORDER BY l.year))*100 percent_forest_lost
            FROM land_area l
            JOIN forest_area f
            ON l.country_code = f.country_code AND l.year = f.year
            JOIN regions r
            ON l.country_code = r.country_code
            WHERE l.year = '1990' OR l.year = '2016'
            ORDER BY 2, 3)

SELECT COUNT(country_name)
FROM table1
WHERE country_name != 'World' AND year = 2016 AND percent_forested > (SELECT
percent_forested
                                                    FROM table1
                                                    WHERE country_name = 'United States' AND year
= 2016)
ORDER BY 1
```