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 **31,666,591.52 Sq.mi** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **30,820,630.87 Sq.mi**, a loss of **845,960.65 Sq.mi** ,or **2.67%**.

The forest area lost over this time period is slightly more than the entire land area of **829,996.14 Sq.mi** listed for the year 2016 (which is **Saudi Arabia**).

2. **REGIONAL OUTLOOK**

In 2016, the percentage of the total land area of the world designated as forest was **31.35%**. The region with the highest relative forestation was **Europe & Central Asia** with **13.08%** and the region with the lowest relative forestation was **Middle East & North Africa**, with **0.29%** forestation.

In 1990, the percentage of the total land area of the world designated as forest was **32.21%.** The region with the highest relative forestation was **Latin America & Caribbean**, with **12.49%**, and the region with the lowest relative forestation was **Middle East & North Africa**, with **0.24%** forestation.

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

Region	1990 Forest Percentage	2016 Forest Percentage
World	50.33	50.06

Latin America & Caribbean	12.49	11.59
Europe & Central Asia	12.44	13.08
Sub-Saharan Africa	7.94	7.66
North America	7.93	8.24
East Asia & Pacific	7.66	8.04
South Asia	0.96	1.05
Middle East & North Africa	0.24	0.29

The only regions of the world that decreased in percent forest area from 1990 to 2016 were **Latin America & Caribbean** (dropped from **12.49**% to **11.59**%) and **Sub-Saharan Africa**(**7.94**% to **7.66**%). 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 **50.33**% to **50.06**%.

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 **0.21%.**. 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 **0.031%**, 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.**India** increased in forest area by **0.027%** 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(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

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	Percent 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 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 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	84
Q2	37
Q3	74
Q4	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.

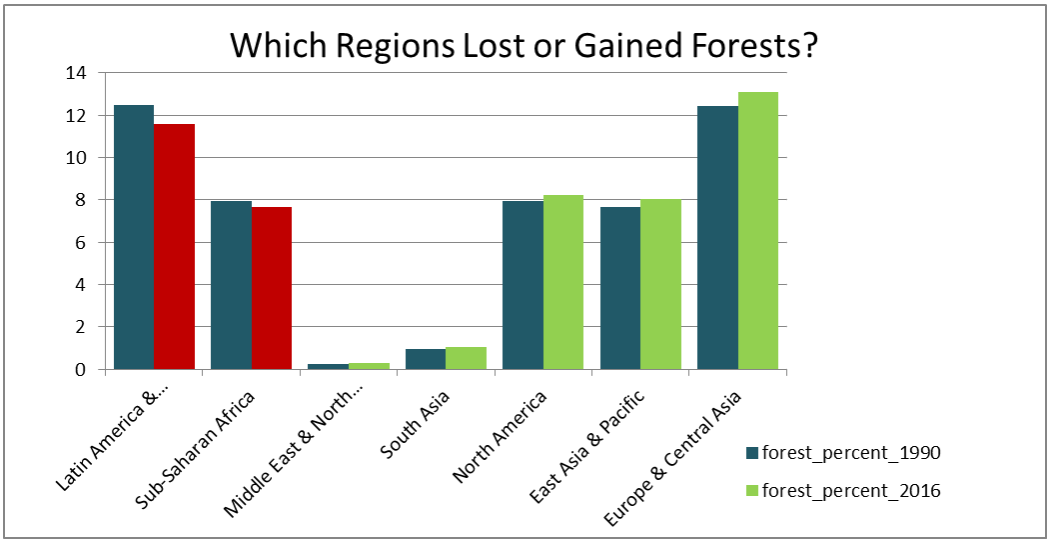
Table 3.4: Top Quartile Countries, 2016:

Country	**Region**	**Percent 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

We've lost **2.1 million square kilometers** of forests since 1990 - 2016, an area larger than **SaudiArabia.**



When we break things down by region, Latin America & the Caribbean has the world's second largest share of forests (after Europe & Central Asia), with about one quarter of the world's total. Since 1990, the region has lost some 992 thousand square kilometers – approx.10 percent of its forest area.

The Table below Shows the comparison of the countries with low forest area and have lost critically large forest areas which would affect the overall climate,water, health and livelihoods.

country	region	forest_area_in_the country_2016(%)	Forest_area_reduced_ 1990_2016(%)
Nigeria	Sub-Saharan Africa	7.23	25.20
Argentina	Latin America & Caribbean	9.8	18.88
Australia	East Asia & Pacific	16.26	8.24
Botswana	Sub-Saharan Africa	18.95	7.05
Uganda	Sub-Saharan Africa	9.68	6.65
Mali	Sub-Saharan Africa	3.8	4.86
Somalia	Sub-Saharan Africa	10.02	4.72

Chad	Sub-Saharan Africa	3.77	4.63
Namibia	Sub-Saharan Africa	8.31	4.54
Burkina Faso	Sub-Saharan Africa	19.34	3.68
Madagascar	Sub-Saharan Africa	21.41	2.92
Pakistan	South Asia	1.85	2.60
Niger	Sub-Saharan Africa	0.89	1.93
Togo	Sub-Saharan Africa	3.09	1.22

Note: the availability of the data showing the reason for deforestation would help to arrive at more findings.

5. APPENDIX: SQL Queries Used

```
– the total forest area of the world in 1990

    WITH t1 AS
        (SELECT year,forest_area_sqkm /2.59 As forest_area_sqmiles
        FROM forest_area)
    SELECT SUM(forest_area_sqmiles)
    FROM t1
    WHERE year=1990;

–the total forest area (in sq km) of the world in 2016
WITH t1 AS
      (SELECT year,forest_area_sqkm /2.59 As forest_area_sqmiles
      FROM forest_area)
SELECT SUM(forest_area_sqmiles)
FROM t1
WHERE year=2016;
```

```
–the change (in sq km) in the forest area of the world from 1990 to 2016
WITH t1 AS
        (SELECT year,forest_area_sqkm /2.59 As forest_area_sqmiles
        FROM forest_area)
SELECT ((SELECT SUM(forest_area_sqmiles)
        FROM t1
                WHERE year=2016)-(SELECT SUM(forest_area_sqmiles) FROM t1
                WHERE year=1990)) AS forest_area_difference
FROM t1;

–compare the amount of forest area lost between 1990 and 2016, to which
country's –total area in 2016 is it closest to

WITH t1 AS
        (SELECT country_name,total_area_sq_mi
        FROM land_area
        WHERE year=2016)
SELECT DISTINCT(country_name),total_area_sq_mi
FROM land_area
WHERE total_area_sq_mi< 845960.65
ORDER BY 2 DESC;

–In 2016, the percentage of the total land area of the world designated as forest
SELECT ROUND(((sum(f.forest_area_sqkm
/2.59)/sum(l.total_area_sq_mi))*100) ::numeric,2) As forest_percent
FROM forest_area f
JOIN land_area l
USING(country_code)
WHERE f.year=2016;

–In 1990, the percentage of the total land area of the world designated as forest
SELECT ROUND(((sum(f.forest_area_sqkm
/2.59)/sum(l.total_area_sq_mi))*100) ::numeric,2) As forest_percent
FROM forest_area f
JOIN land_area l
```

```
USING(country_code)
WHERE f.year=1990;

–Regional Outlook
WITH t1 AS
        (SELECT country_code,forest_area_sqkm/2.59 AS Forest_area_Sqmi
    FROM forest_area
    WHERE year=1990),
 t2 AS
        (SELECT country_code,forest_area_sqkm/2.59 AS Forest_area_Sqmi
    FROM forest_area
    WHERE year=2016),
 t3 AS
        (SELECT r.region,SUM(t1.Forest_area_Sqmi) AS
total_forest_area_1990, SUM(t2.Forest_area_Sqmi) AS total_forest_area_2016
   FROM regions r
   JOIN t1
   ON r.country_code=t1.country_code
   JOIN t2
   ON r.country_code=t2.country_code
   GROUP BY 1
   ORDER BY 2 DESC)
SELECT t3.region,ROUND(((t3.total_forest_area_1990/(SELECT
SUM(forest_area_sqkm)/2.59 FROM forest_area WHERE
year=1990))*100)::numeric,2) AS
forest_percent_1990,ROUND(((t3.total_forest_area_2016/(SELECT
SUM(forest_area_sqkm)/2.59 FROM forest_area WHERE
year=2016))*100)::numeric,2) AS forest_percent_2016
FROM t3;

—-Country level percentage difference 1990-2016
WITH t1 AS
        (SELECT country_code,forest_area_sqkm/2.59 AS Forest_area_Sqmi
    FROM forest_area
    WHERE year=1990),
 t2 AS
```

```
        (SELECT country_code,forest_area_sqkm/2.59 AS Forest_area_Sqmi
    FROM forest_area
    WHERE year=2016),
 t3 AS
        (SELECT r.region,t1.country_code AS country_code,
SUM(t1.Forest_area_Sqmi) AS          total_forest_area_1990,
SUM(t2.Forest_area_Sqmi) AS total_forest_area_2016
   FROM regions r
   JOIN t1
   ON r.country_code=t1.country_code
   JOIN t2
   ON r.country_code=t2.country_code
   GROUP BY 1,2
   ORDER BY 3 DESC),
t4 AS
        (SELECT t3.region,r.country_name,
(t3.total_forest_area_1990*100/(SELECT SUM(total_area_sq_mi) FROM
land_area WHERE year=1990)) AS forest_percent_1990,
(t3.total_forest_area_2016*100/(SELECT SUM(total_area_sq_mi) FROM
land_area WHERE year=2016)) AS forest_percent_2016
        FROM t3
        JOIN regions r
        ON r.country_code=t3.country_code
        ORDER BY 3 DESC)

SELECT t4.country_name,
ROUND((t4.forest_percent_2016-t4.forest_percent_1990)::numeric,2) AS
Forest_growth_percent_1990_to_2016
FROM t4
WHERE t4.forest_percent_2016 IS NOT NULL AND t4.forest_percent_1990 IS
NOT NULL
ORDER BY 2 DESC;

–Top 5 Amount Decrease in Forest Area by Country, 1990 & 2016:

WITH t1 AS
```

```
        (SELECT f.country_name AS country, r.region AS
region,SUM(forest_area_sqkm) AS total_forest_area_1990
    FROM forest_area f
    JOIN regions r
    USING(country_code)
    WHERE year=1990
   GROUP BY 1,2),
 t2 AS
        (SELECT f.country_name AS country,r.region as
region,SUM(forest_area_sqkm) AS total_forest_area_2016
    FROM forest_area f
    JOIN regions r
    USING(country_code)
    WHERE year=2016
   GROUP BY 1,2)
SELECT
t1.country,t1.region,ROUND((t2.total_forest_area_2016-t1.total_forest_area_199
0)::numeric,2) AS forest_area_change
FROM t1
JOIN t2
USING(country)
WHERE t2.total_forest_area_2016 IS NOT NULL AND t1.total_forest_area_1990
IS NOT NULL AND country <> 'World'
ORDER BY 3
LIMIT 5;
```

–Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016:

```
WITH t1 AS
        (SELECT country_code,forest_area_sqkm/2.59 AS Forest_area_Sqmi
    FROM forest_area
    WHERE year=1990),
  t2 AS
        (SELECT country_code,forest_area_sqkm/2.59 AS Forest_area_Sqmi
    FROM forest_area
```

```
    WHERE year=2016),
 t3 AS
        (SELECT r.country_name AS country_name, r.region AS region,
SUM(t1.Forest_area_Sqmi) AS         total_forest_area_1990,
SUM(t2.Forest_area_Sqmi) AS total_forest_area_2016
          FROM regions r
         JOIN t1
          ON r.country_code=t1.country_code
         JOIN t2
        ON r.country_code=t2.country_code
        GROUP BY 1,2
         ORDER BY 3 DESC)
SELECT t3.country_name,t3.region,
ROUND((((t3.total_forest_area_2016-t3.total_forest_area_1990)*2.59)*100/(t3.to
tal_forest_area_1990*2.59))::numeric,2)
 AS Percent_Forest_area_growth_SqKm
FROM t3
ORDER BY 3 ;
```

—Count of Countries Grouped by Forestation Percent Quartiles, 2016

```
WITH t1 AS
        (SELECT country_code,f.country_name,
(SUM(f.forest_area_sqkm)*100)/SUM(l.total_area_sq_mi *2.59) AS
forest_percentile
    FROM forest_area f
    JOIN land_area l
    USING(country_code)
    WHERE f.year=2016
    GROUP BY 1,2
    ORDER BY 3 DESC)
SELECT
  CASE
   WHEN forest_percentile <= 25  AND  forest_percentile IS NOT  NULL  THEN
'Q1'
   WHEN forest_percentile<= 50 AND  forest_percentile IS NOT  NULL THEN
'Q2'
```

```
   WHEN forest_percentile<= 75 AND  forest_percentile IS NOT  NULL  THEN
'Q3'
   WHEN forest_percentile<= 100 AND forest_percentile IS NOT  NULL THEN
'Q4'
   ELSE 'Null valued'
  END AS quartile,
  COUNT(*) AS number_of_countries
FROM  t1
GROUP BY 1;
```

–Top Quartile Countries, 2016:

```
SELECT f.country_name, r.region,
ROUND(((SUM(f.forest_area_sqkm)*100)/SUM(l.total_area_sq_mi
*2.59))::numeric,2) AS forest_percentile
    FROM forest_area f
    JOIN land_area l
    USING(country_code)
    JOIN regions r
    USING(country_code)
    WHERE f.year=2016 AND l.total_area_sq_mi IS NOT NULL AND
f.forest_area_sqkm IS NOT NULL
    GROUP BY 1,2
  HAVING (SUM(f.forest_area_sqkm)*100)/SUM(l.total_area_sq_mi *2.59)>75
  ORDER BY 3 DESC;
```