# 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 in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9**, a loss of 1324449, or 3.208%.

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 1279999.989).

## 2. REGIONAL OUTLOOK

In 2016, the percent of the total land area of the world designated as forest was 31.37. The region with the highest relative forestation was Latin America & Caribbean, with 46.16%, and the region with the lowest relative forestation was Middle East & 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 & Caribbean, with 51.03%, and the region with the lowest relative forestation was Middle East & 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 & Caribbean | 51.03 | 46.16 |
| Europe & Central Asia | 37.28 | 38.04 |
| North America | 35.65 | 36.04 |
| Sub-Saharan Africa | 30.67 | 28.79 |
| East Asia & Pacific | 25.78 | 26.36 |
| South Asia | 16.51 | 17.51 |
| 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 & 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 31.37%.

# 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. 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, much lower than the figure for Iceland.

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 & Caribbean | 541510 |
| Indonesia | East Asia & Pacific | 282193.9844 |
| Myanmar | East Asia & Pacific | 107234.0039 |
| Nigeria | Sub-Saharan Africa | 106506.00098 |
| 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 | 75.4452559270073 |
| 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 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 |
|---|---|
| 0-25% | 85 |
| 25-50% | 73 |
| 50-75% | 38 |
| 75-100% | 9 |

The largest number of countries in 2016 were found in the 0-25% 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 |

# 5. RECOMMENDATIONS

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

- *What have you learned from the World Bank data?*
- *From 1990 to 2016, global forest areas decreased by 3.02%.*
  *Deforestation, corruption, climate change, resource theft, pasturage saturation, and other factors contribute to this downfall.*
  *Although most regions of the world have increased their forest areas, two regions have decreased them: Latin America & the Caribbean, and Sub-Saharan Africa.*
  *Since 1990, many countries and governments have worked hard to increase the mass of threes. In order to maintain an optimal balance in nature, there are many challenges ahead.*

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

  *According to the data, the top 5 countries that have decreased their forest areas are Togo with almost 76%, Nigeria with 62%, Uganda with 59%, Mauritania with 47%, and Honduras with 54% from 1990 to 2016.*
  *In addition to most regions of the world having increased forest areas, two regions have decreased them: Latin America & Caribbean and Sub-Saharan Africa*

6. APPENDIX: SQL queries used

.1

```
;DROP VIEW IF EXISTS forestation

) CREATE VIEW forestation AS
,SELECT f.year
,r.income_group, l.total_area_sq_mi
f.forest_area_sqkm, F.COUNTRY_CODE , f.country_name, r.region, (l.total_area_sq_mi * 2.59)
as total_area_sqkm , ((f.forest_area_sqkm /(l.total_area_sq_mi *2.59))*100 ) as land_precnt
FROM forest_area F
INNER JOIN land_area AS L ON F.COUNTRY_CODE = L.COUNTRY_CODE AND
F.YEAR = L.YEAR
INNER JOIN REGIONS AS R ON R.COUNTRY_CODE = F.COUNTRY_CODE
(
```

P 1 GLOBAL SITUATION

–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 *
from forest_area
where country_name = 'World' and (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 *
from forest_area
where country_name = 'World' and (year = 2016 );
```

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

```
SELECT b.forest_area_sqkm - a.forest_area_sqkm as change
FROM forest_area a
```

```
join forest_area b
        on (a.year = '1990' and b.year = '2016' and a.country_name = 'World' and
b.country_name = 'World');
```

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

```
select 100.0*((b.forest_area_sqkm -a.forest_area_sqkm) / a.forest_area_sqkm) as
precent_change
from forest_area a
join forest_area b
        on (a.year = '1990' and b.year = '2016' and a.country_name = 'World' and
b.country_name = 'World');
```

–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?

```
select country_name, total_area_sqkm
from forestation
where year = 2016 and total_area_sqkm < 1324449
order by 2 desc
limit 1
```

## 2. REGIONAL OUTLOOK

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?

```
SELECT land_precnt
FROM forestation
WHERE country_name = 'World' and 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?

```
SELECT land_precnt
FROM forestation
WHERE country_name = 'World' and year = '1990'
```

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

```
SELECT ROUND(CAST((region_forest_1990/ region_area_1990) * 100 AS NUMERIC), 2)
  AS forest_percent_1990,
  ROUND(CAST((region_forest_2016 / region_area_2016) * 100 AS NUMERIC), 2)
  AS forest_percent_2016,
  region
FROM (SELECT SUM(a.forest_area_sqkm) region_forest_1990,
  SUM(a.total_area_sqkm) region_area_1990, a.region,
  SUM(b.forest_area_sqkm) region_forest_2016,
  SUM(b.total_area_sqkm) region_area_2016
FROM forestation a, forestation b
WHERE a.year = '1990'
AND a.country_name != 'World'
AND b.year = '2016'
AND b.country_name != 'World'
AND a.region = b.region
GROUP BY a.region) region_percent
ORDER  BY forest_percent_1990 DESC;
```

## 3. COUNTRY-LEVEL DETAIL

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?

```
SELECT new.country_name as top_countries,
```

```
 ( new.forest_area_sqkm - pre.forest_area_sqkm ) AS difference
FROM forest_area AS new
JOIN forest_area AS pre
  ON  (new.year = '2016' AND pre.year = '1990')
  AND new.country_name = pre.country_name
  where new.forest_area_sqkm is not null
  and pre.forest_area_sqkm is not null
  and new.country_name != 'World'
  and pre.country_name != 'World'
ORDER BY difference DESC 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?

```
SELECT new.country_name as top_countries,
 ( 100 *(new.forest_area_sqkm - pre.forest_area_sqkm )/ pre.forest_area_sqkm ) AS
difference
FROM forest_area AS new
JOIN forest_area AS pre
  ON  (new.year = '2016' AND pre.year = '1990')
  AND new.country_name = pre.country_name
  where new.forest_area_sqkm is not null
  and pre.forest_area_sqkm is not null
  and new.country_name != 'World'
  and pre.country_name != 'World'
ORDER BY difference DESC limit 5
```

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

```
SELECT DISTINCT(QUARTIELS) , COUNT(country_name) over (PARTITION BY
QUARTIELS) as countries
FROM (select country_name, case when land_precnt <= 25 then '0-25%'
```

```
      when land_precnt <= 75 and land_precnt > 50 then '50-75%'
      when land_precnt<= 50 and land_precnt > 25 then ' 25-50%'
      else ' 75-100%'
      end as QUARTIELS
from forestation
where (land_precnt is not null and year = 2016 ) and country_name <> 'world') quart;
```

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

```
SELECT COUNTRY_NAME, REGION, LAND_PRECNT
FROM forestation
WHERE (YEAR = 2016 AND LAND_PRECNT >75)
ORDER BY LAND_PRECNT DESC
```

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

```
SELECT new.COUNTRY_NAME,
(new.forest_area_sqkm - pre.forest_area_sqkm) as difference
FROM forest_area new
join forest_area pre
on (pre.YEAR = 2016 AND new.year = '2016') and new.country_name = pre.country_name
where new.forest_area_sqkm is not null
and pre.forest_area_sqkm is not null
ORDER BY 2 DESC
limit 3;
```

```
SELECT new.COUNTRY_NAME,
(100*(new.forest_area_sqkm - pre.forest_area_sqkm)/ pre.forest_area_sqkm) as pro_change
FROM forest_area new
join forest_area pre
on (pre.YEAR = 2016 AND new.year = '2016') and new.country_name = pre.country_name
where new.forest_area_sqkm is not null
```

```
and pre.forest_area_sqkm is not null
ORDER BY pro_change DESC
limit 3;
```