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 Sq Km in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39,958,245.9 Sq Km, a loss of 1,324,449 Sq Km or 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 Sq Km).

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 & 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 98.91%, and the region with the lowest relative forestation was Middle East & North Africa with 12.81% forestation.

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

Region	1990 Forest Percentage	2016 Forest Percentage
North America	35.65	36.04
East Asia & Pacific	25.78	26.36
World	32.42	31.38
Latin America & Caribbean	51.03	46.16
Middle East & North Africa	1.78	2.07
South Asia	16.51	17.51
Sub-Saharan Africa	30.67	28.79
Europe & Central Asia	37.28	38.04

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 31.38%.

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 Sq Km. 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 Sq Km (2.62%), 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 213.66% 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	-541,510.00
Indonesia	East Asia & Pacific	-282,193.98
Myanmar	East Asia & Pacific	-107,234.00
Nigeria	Sub-Saharan Africa	-106,506.00
Tanzania	Sub-Saharan Africa	-102,320.00

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	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 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 (0-25%)	85
Q2 (>25-50%)	72
Q3 (>50-75%)	38
Q4 (>75-100%)	9

The largest number of countries in 2016 were found in the Q1 (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	98.26
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

5. RECOMMENDATIONS

The data provided by the World Bank provides a glimpse of the global trend of deforestation. As noted earlier in the report the world has lost 3.2% of its forest during the 1990-2016 time period. While there were some indications in the report that some areas had increased their level of forestation, overall, the world has been on a depressing trend downward. It is not clear why deforestation is happening from this report, although it could be suspected that increasing development, population increases, land use management, political and

economic instability, and global warming could all be factors in this trend. More analysis would be needed to create a plan to combat this overall trend.

However, it is clear that something must be done. Brazil topped the list in loss of forest. The Amazonian rainforest is known as “the lungs of the world” any changes in this ecosystem could have a significant impact upon the world. Focus should be on the areas of greatest decrease. This would have a much larger impact on the global trend and allow better use of ForestQuery’s limited resources. Deforestation is a complex issue stemming from multiple sources. It is likely that the only approach successful will involve political, business, and educational leaders to partner to stem the reduction of forested areas.

Appendix - SQL Queries Used

```
CREATE VIEW forestation
AS SELECT
f.country_code Code, f.country_name Country, f.year, f.forest_area_sqkm Area, ROU
ND(CAST(l.total_area_sq_mi as numeric) * 2.59,2) AS area_km, r.region Region, r.i
ncome_group, ROUND(CAST(f.forest_area_sqkm as numeric) /(CAST(l.total_area_sq_mi
as numeric) *2.59)* 100,2) AS Percent_Forested
FROM forest_area f, land_area l, regions r
WHERE f.country_code=l.country_code AND f.year = l.year
AND l.country_code=r.country_code;

-
- 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 tabl
e.

SELECT area
FROM forestation
WHERE country = 'World' AND year = 1990;

-- 41282694.9

-
- 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 area
FROM forestation
WHERE country = 'World' AND year = 2016;
-- 39958245.9

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

SELECT b.area-a.area
AS loss
FROM forestation AS a
JOIN forestation  AS b
  ON  (a.year = '1990' AND b.year = '2016'
  AND a.country = 'World' AND b.country = 'World');
-- -1324449
```

```
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- d. What was the percent change in forest area of the world between 1990 and 201
6?

SELECT ROUND((CAST(b.area as numeric) - CAST(a.area as numeric) )* 100 / CAST(b.a
rea as numeric),2) AS percent_loss
    FROM forestation as a
    JOIN forestation as b
        ON  (a.year = '1990' AND b.year = '2016'
        AND a.country = 'World' AND b.country = 'World');
-- -3.21

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- e. If you compare the amount of forest area lost between 1990 and 2016, to whic
h country's total area in 2016 is it closest to?

SELECT country, area_km As SqKm
    FROM forestation
    WHERE year = 2016 AND area_km < (SELECT ABS(b.area-a.area)
AS loss
FROM forestation AS a
JOIN forestation  AS b
  ON  (a.year = '1990' AND b.year = '2016'
  AND a.country = 'World' AND b.country = 'World'))
    ORDER BY area_km DESC
    LIMIT 1;
-- Peru 1279999.99

-- Part II
CREATE VIEW forestation
AS SELECT
f.country_code Code, f.country_name Country, f.year, f.forest_area_sqkm Area, l.t
otal_area_sq_mi * 2.59 AS area_km, r.region Region,
r.income_group, ROUND(CAST(f.forest_area_sqkm as numeric)/CAST(l.total_area_sq_mi
 *2.59 as numeric)* 100,2) AS Percent_Forested
FROM forest_area f, land_area l, regions r
WHERE f.country_code=l.country_code AND f.year = l.year
AND l.country_code=r.country_code;

CREATE View Region AS
SELECT region, ROUND((SUM(CAST(area as numeric))/SUM(CAST(area_km as numeric)))*1
00, 2) AS Regions, year
FROM forestation
GROUP BY region,year;
```

```sql
-- a. What was the percent forest of the entire world in 2016?

SELECT region,regions as Percent_Forested
FROM Region
WHERE year = 2016 AND region = 'World'
GROUP BY region,regions;

--World 31.38

--
Which region had the HIGHEST percent forest in 2016, and which had the LOWEST, to
 2 decimal places?
(SELECT region,regions AS Forested_Area
FROM region
WHERE year = 2016
order by regions DESC
LIMIT 1)
UNION ALL
(SELECT region,regions AS Forested_Area
FROM region
WHERE year = 2016
order by regions ASC
LIMIT 1);

--Latin America & Caribbean 46.16
--Middle East & North Africa    2.07

--Table 2.1: Percent Forest Area by Region, 1990 & 2016:
SELECT region,
max(case when year = 1990 then Regions end) as "1990",
max(case when year = 2016 then Regions end) as "2016"
FROM Region
WHERE year = 1990 or year = 2016
GROUP BY region;

---Part III

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Which 5 countries saw the largest amount decrease in forest area from 1990 to 201
6? What was the difference in forest area for each?

SELECT a.country AS country, a.region as region,ROUND(CAST(b.area AS numeric)- RO
UND(CAST(a.area AS numeric),2)) AS Change,ROUND((CAST(b.area AS numeric)- CAST(a.
area AS numeric))/CAST(b.area as numeric)*100,2) AS Percent
FROM forestation AS a
```

```
JOIN forestation  AS b
  ON  b.year = '1990' AND a.year = '2016' and a.country = b.country
  WHERE a.country <> 'World'
  GROUP by a.country, a. region,change,percent
  ORDER by Change ASC -- order by percent for increase in percent
  LIMIT 5;


--Table 3.1: Top 5 Amount Decrease in Forest Area by Country, 1990 & 2016:

SELECT a.country AS country, a.region as region, ROUND(CAST(a.area as numeric)-
CAST(b.area as numeric),2) as Total_Change
FROM forestation AS a
JOIN forestation  AS b
  ON  b.year = '1990' AND a.year = '2016' and a.country = b.country
  WHERE a.country <> 'World'
  GROUP by a.country, a. region,Total_change
  ORDER by Total_Change ASC
  LIMIT 5;


  --Table 3.2: Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016:
  --
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 a.country AS country, a.region as Region,ROUND((CAST(b.area AS numeric) -
CAST(a.area AS numeric))/CAST(a.area AS numeric)*100,2) AS Percentage_loss
FROM forestation AS a
JOIN forestation  AS b
  ON  a.year = '1990' AND b.year = '2016' and a.country = b.country
  WHERE a.country <> 'World'
  GROUP by a.country, a.region,percentage_loss
  ORDER by percentage_loss ASC
  LIMIT 5;

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- Table 3.3: Count of Countries Grouped by Forestation Percent Quartiles, 2016:
  --
c. If countries were grouped by percent forestation in quartiles, which group had
 the most countries in it in 2016?

WITH a AS(SELECT country, percent_forested
FROM forestation
WHERE year = 2016
```

```sql
AND country <> 'World'
)
SELECT
COUNT(CASE WHEN a.percent_forested <= 25 THEN 1 ELSE NULL END) AS q1,
COUNT(CASE WHEN a.percent_forested > 25 AND a.percent_forested <= 50 THEN 1 ELSE
NULL END) AS q2,
COUNT(CASE WHEN a.percent_forested > 50 AND a.percent_forested <= 75 THEN 1 ELSE
NULL END) AS q3,
COUNT(CASE WHEN a.percent_forested > 75 THEN 1 ELSE NULL END) AS q4
FROM a;

--Table 3.4: Top Quartile Countries, 2016:
--
d. List all of the countries that were in the 4th quartile (percent forest > 75%)
 in 2016.

SELECT country,region, percent_forested
FROM forestation
WHERE year = 2016
AND country <> 'World'
AND percent_forested > 75
ORDER BY Percent_forested DESC;

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

SELECT COUNT(country) percent_forested
FROM forestation
WHERE year = 2016
AND country <> 'World'
AND percent_forested > (SELECT percent_forested FROM forestation WHERE country =
'United States' AND year = 2016)
Order by percent_forested DESC;

-- 94
```