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 sqkm** in **1990**. As of **2016**, the most recent year for which data was available, that number had fallen to **39958245.9 sqkm**, a loss of **1324449 sqkm**, 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 **1279999**.**9 sqkm**).

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
Latin America & Caribbean	43.34	41.64
Sub-Saharan Africa	35.26	31.28
East Asia & Pacific	47.38	50.09
Middle East & North Africa	2.69	3.19

The only regions of the world that decreased in percent forest area from **1990** to **2016** were **Latin America & Caribbean** (**dropped** from **43.34 % to 41.64 %)** and **Sub-Saharan Africa (35.26 % to 31.28 %).** 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 31.28 %.**

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 sqkm**. 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 sqkm**, 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. **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	541510.00
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	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, Mauritania, and Uganda** . 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
American Samoa	East Asia & Pacific	87.50
Gabon	Sub-Saharan Africa	90.04

Guyana	Latin America & Caribbean	83.90
Lao PDR	East Asia & Pacific	82.11
Micronesia, Fed. Sts.	East Asia & Pacific	91.86
Palau	East Asia & Pacific	87.61
Seychelles	Sub-Saharan Africa	88.41
Solomon Islands	East Asia & Pacific	77.86
South Sudan	Sub-Saharan Africa	98.26

4. RECOMMENDATIONS

As an analyst of the ForestQuery team, I am alarmed by these findings. Climate change and deforestation are real. We have to take this seriously and raise awareness to combat deforestation.
Our primary focus should be on countries from Sub-Saharan Africa region.
They are **Togo, Nigeria, Mauritania, and Uganda.**

5. Appendix : SQL queries used

/*

Steps to Complete

Create a View called “forestation” by joining all three tables - forest_area, land_area and regions in the workspace.
The forest_area and land_area tables join on both country_code AND year. The regions table joins these based on only country_code */

```
CREATE VIEW forestation AS
    SELECT
        f.country_code,
        f.country_name,
        r.region,
        f.year,
        f.forest_area_sqkm,
        l.total_area_sq_mi,
        (l.total_area_sq_mi * 2.59) AS land_total_area_sqkm,
        f.forest_area_sqkm / (l.total_area_sq_mi * 2.59) AS
percent_landarea_as_forest,
        (f.forest_area_sqkm / (l.total_area_sq_mi * 2.59)) * 100 AS
per_landarea_as_forest,
        r.income_group
    FROM
        forest_area f
            LEFT JOIN
        land_area l ON f.country_code = l.country_code
            AND f.year = l.year
            LEFT JOIN
        regions r ON l.country_code = r.country_code;
```

1.**Global Situation:**

```
/*
What was the total forest area (in sq km) of the world in 1990?
*/

SELECT
```

```
    SUM(forest_area_sqkm)
FROM
    forestation
WHERE
    year = 1990 AND country_code != 'WLD';

SELECT
    (forest_area_sqkm)
FROM
    forestation
WHERE
    year = 1990 AND country_code = 'WLD';

-- 40733777.136028
-- 41282694.9
-- The total forest area in world was 41282694.9 sqkm in the 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
    forest_area_sqkm
FROM
    forestation
WHERE
    year = 2016 AND country_code = 'WLD';
```

```
-- 39958245.9
-- The total forest area in 2016 was 39958245.9 sqkm

/*
What was the change (in sq km) in the forest area of the world
from 1990 to 2016?
41282694.9 - 39958245.9 = 1324449
*/
SELECT
    previous.forest_area_sqkm AS forest_area_1990,
    current.forest_area_sqkm AS forest_area_2016,
    (previous.forest_area_sqkm - current.forest_area_sqkm) AS
difference
FROM
    forestation current
        JOIN
    forestation previous ON (current.year = '2016'
        AND previous.year = '1990'
        AND current.country_code = 'WLD'
        AND previous.country_code = 'WLD')
;



/*
What was the percent change in forest area of the world between
1990 and 2016?
1324449/41282694.9 = 0.03208 = 3.21%
*/
```

```
SELECT
    previous.forest_area_sqkm AS forest_area_1990,
    current.forest_area_sqkm AS forest_area_2016,
    ((previous.forest_area_sqkm - current.forest_area_sqkm) /
previous.forest_area_sqkm) * 100 AS
percent_change_forest_area
FROM
    forestation current
        JOIN
    forestation previous ON (current.year = '2016'
        AND previous.year = '1990'
        AND current.country_code = 'WLD'
        AND previous.country_code = 'WLD');




/*
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_code, country_name, land_total_area_sqkm
FROM
    forestation
WHERE
    year = 2016
```

```
ORDER BY land_total_area_sqkm;


-- PER      Peru 1279999.9891
```

2. **Regional Outlook**:

```
-- 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
    *
FROM
    forestation
WHERE
    year = '2016' AND country_code = 'WLD';
-- 31.38% world forest percent area.

SELECT
    region, AVG(per_landarea_as_forest) AS avg_2016_forest
FROM
    forestation
WHERE
    year = '2016' AND region != 'World'
GROUP BY region
ORDER BY avg_2016_forest DESC
LIMIT 1;

SELECT
    region, AVG(per_landarea_as_forest) AS avg_1990_forest
```

```
FROM
    forestation
WHERE
    year = '1990' AND region != 'world'
GROUP BY region
ORDER BY avg_1990_forest DESC
LIMIT 1;

-- East Asia & Pacific       47.383706517048985

SELECT
    region, AVG(per_landarea_as_forest) AS avg_1990_forest
FROM
    forestation
WHERE
    year = '1990' AND region != 'world'
GROUP BY region
ORDER BY avg_1990_forest
LIMIT 1;

-- Middle East & North Africa   2.6929000806116377


SELECT
    region, AVG(per_landarea_as_forest) AS avg_2016_forest
FROM
    forestation
WHERE
    year = '2016' AND region != 'World'
GROUP BY region
```

```
ORDER BY avg_2016_forest
LIMIT 1;

-- Middle East & North Africa   3.1916638284055843

create temporary table avg_2016
SELECT
    region, AVG(per_landarea_as_forest) AS avg_2016_forest
FROM
    forestation
WHERE
    year = '2016' AND region != 'World'
GROUP BY region
ORDER BY avg_2016_forest DESC;

create temporary table avg_1990
SELECT
    region, AVG(per_landarea_as_forest) AS avg_1990_forest
FROM
    forestation
WHERE
    year = '1990' AND region != 'world'
GROUP BY region
ORDER BY avg_1990_forest DESC;

SELECT
    a.region,
    a.avg_1990_forest AS forest_1990,
    b.avg_2016_forest AS forest_2016
FROM
```

```
    avg_1990 a
        JOIN
    avg_2016 b ON a.region = b.region
```

/*
The only regions that decreased the forest area are Latin America and Carribean, and Sub-Saharan Africa.
REst other regions increased their forest area from 1990 to 2016.

East Asia & Pacific 47.383706517048985
        50.09068566190981
Latin America & Caribbean   43.344817645245065
        41.64367220079187
Sub-Saharan Africa 35.26154587362054
        31.28087228138833
North America 29.946461672557575   30.20311217629856
Europe & Central Asia   26.327139226545235
        28.305655815238428
South Asia   20.67738607866031   21.599857981327805
Middle East & North Africa   2.692900080611637 7
        3.1916638284055843
*/

3**.Country Level:**

/*
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
   *
FROM
   forestation
LIMIT 10;

create temporary table forest_area_country_1990
SELECT
   country_name,
   region,
   SUM(forest_area_sqkm) AS total_forest_area_1990
FROM
   forestation
WHERE
   year = 1990
GROUP BY country_name;


create temporary table forest_area_country_2016
SELECT
   country_name,
   region,
   SUM(forest_area_sqkm) AS total_forest_area_2016
FROM
   forestation
WHERE
   year = 2016
GROUP BY country_name;
```

```
SELECT
    a.country_name,
    a.region,
    ROUND((b.total_forest_area_1990 - total_forest_area_2016),
        2) AS Absolute_forest_area_change
FROM
    forest_area_country_2016 a
        JOIN
    forest_area_country_1990 b ON a.country_name =
b.country_name
WHERE
    a.country_name != 'world'
ORDER BY Absolute_forest_area_change DESC
LIMIT 5;

-- We can see that the below are the top 5 countries where
foreast area decreased from 1990 to 2016

SELECT
    a.country_name,
    a.region,
    ROUND((b.total_forest_area_1990 - total_forest_area_2016),
        2) AS Absolute_forest_area_change
FROM
    forest_area_country_2016 a
        JOIN
    forest_area_country_1990 b ON a.country_name =
b.country_name
ORDER BY Absolute_forest_area_change ASC;
```

```
-- limit 10;

SELECT
    *
FROM
    forestation
LIMIT 10;

create temporary table forest_1990
SELECT
    country_name, region, forest_area_sqkm
FROM
    forestation
WHERE
    year = 1990
;

create temporary table forest_2016
SELECT
    country_name, region, forest_area_sqkm
FROM
    forestation
WHERE
    year = 2016;

SELECT
    a.country_name,
    a.region,
    ROUND(((b.forest_area_sqkm - a.forest_area_sqkm) /
b.forest_area_sqkm) * 100,
```

```
        2) AS percent_forest
FROM
    forest_2016 a
        JOIN
    forest_1990 b ON a.country_name = b.country_name
ORDER BY percent_forest DESC
LIMIT 5;

-- The percent forest area decrease from 1990 to 2016, below are
the top 5 countries:
/*
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
*/

SELECT
    a.country_name,
    a.region,
    ROUND(((b.forest_area_sqkm - a.forest_area_sqkm) /
b.forest_area_sqkm) * 100,
        2) AS percent_forest
FROM
    forest_2016 a
        JOIN
    forest_1990 b ON a.country_name = b.country_name
ORDER BY percent_forest ASC
LIMIT 5;
```

/*
Top 5 countries with most percent_forest increase from 1990 to 2016
 Success stories:
Iceland Europe & Central Asia -213.66
French Polynesia East Asia & Pacific -181.82
Bahrain Middle East & North Africa -177.27
Uruguay Latin America & Caribbean -134.11
Dominican Republic Latin America & Caribbean -82.46

*/

/*
c. If countries were grouped by percent forestation in quartiles, which group had the most countries in it in 2016?
*/
```
create temporary table percent_forest
SELECT
    a.country_name,
    a.region,
    ROUND(((b.forest_area_sqkm - a.forest_area_sqkm) /
b.forest_area_sqkm) * 100,
            2) AS percent_forest
FROM
    forest_2016 a
        JOIN
    forest_1990 b ON a.country_name = b.country_name
ORDER BY percent_forest DESC;
```

```
SELECT
    *
FROM
    forestation
LIMIT 10;
create temporary table percentforestation_per_country
select
country_name,
region,
round(per_landarea_as_forest, 2) as percent_forestation
from
forestation
where
year=2016;

SELECT
    *
FROM
    percentforestation_per_country;

create temporary table country_quartiles_1
select
(country_name) as total_count_of_countries,
case
 when percent_forestation <=25 then '0-25%'
 when percent_forestation > 25 and percent_forestation <=50
then '25-50%'
```

```
 when percent_forestation > 50 and percent_forestation < 75 then
'50-75%'
ELSE '75-100%' end as Quartiles
from
percentforestation_per_country;

SELECT
    *
FROM
    country_quartiles_1;

SELECT
    Quartiles,
    COUNT(CASE
        WHEN Quartiles = '0-25%' THEN (total_count_of_countries)
        ELSE NULL
    END) AS per_1,
    COUNT(CASE
        WHEN Quartiles = '25-50%' THEN
(total_count_of_countries)
        ELSE NULL
    END) AS per_2,
    COUNT(CASE
        WHEN Quartiles = '50-75%' THEN
(total_count_of_countries)
        ELSE NULL
    END) AS per_3,
    COUNT(CASE
        WHEN Quartiles = '75-100%' THEN
(total_count_of_countries)
```

```
        ELSE NULL
    END) AS per_4
FROM
    country_quartiles_1
GROUP BY Quartiles;

/*
There are total 85 countries which are in 0-25 %  of forest area of
total land area.
0-25%      85
25-50%    73
50-75%    38
75-100%  11

*/

SELECT
    a.total_count_of_countries, b.region
FROM
    country_quartiles_1 a
        LEFT JOIN
    regions b ON a.total_count_of_countries = b.country_name
WHERE
    Quartiles = '75-100%';

/*
Below are the countries in top  Quartile for percent forestation. i.e
More land is designated as forest area.
American Samoa     75-100%
Gabon      75-100%
```

```
Guyana    75-100%
Lao PDR  75-100%
Micronesia, Fed. Sts.       75-100%
Palau       75-100%
Seychelles       75-100%
Solomon Islands      75-100%
Suriname 75-100%
Sudan      75-100%
South Sudan    75-100%
*/

SELECT
    AVG(per_landarea_as_forest)
FROM
    forestation
WHERE
    country_code = 'USA';

-- 33.36 %

SELECT
    country_name, AVG(per_landarea_as_forest)
FROM
    forestation
GROUP BY country_name
HAVING AVG(per_landarea_as_forest) > 33.36;

SELECT
    *
FROM
```

```
    percentforestation_per_country;

SELECT
    *
FROM
    country_quartiles_1;

/*
To find the percent forest area for top Quartile for 2016 year
*/
SELECT
    a.country_name, a.region, a.percent_forestation, b.Quartiles
FROM
    percentforestation_per_country a
        JOIN
    country_quartiles_1 b ON a.country_name =
b.total_count_of_countries
WHERE
    b.Quartiles = '75-100%'
```