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 **41282694.90** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.90**, a loss of **1324449**, 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 **1279999.99 km²).**

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 **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 **31.38**%.

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**. 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 **79200.00**, 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 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**, **Uganda, Nigeria**, and **Mauritania**. The 5th country on the list is **Honduras**, which is in the **Latin America & Caribbean Islands** 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	Sub-Saharan Africa	98.26
Micronesia, Fed. Sts	East Asia & Pacific	91.86
Gabon	Sub-Saharan Africa	90.04
Guyana	Latin America & Caribbean	83.90
Lao PDR	East Asia & Pacific	82.11
Palau	East Asia & Pacific	87.61
Solomon Islands	East Asia & Pacific	77.86
Suriname	Latin America & Caribbean	98.26

Seychelles	Sub-Saharan Africa	88.41

4. RECOMMENDATIONS

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

- What have you learned from the World Bank data?
- Which countries should we focus on over others?

As an analyst on the ForestQuery team, here are my recommendations based on our analysis of the World Bank data:

A **Identify Priority Countries**: Utilizing the World Bank data, we've discerned several key insights regarding forest coverage, deforestation rates, and environmental policies across different nations. It's evident that certain countries are experiencing more pronounced challenges in forest conservation and management compared to others. Therefore, our focus should be on prioritizing countries where urgent action is required to address deforestation, biodiversity loss, and related environmental issues. These priority countries can be identified based on criteria such as high deforestation rates, significant forest cover loss, lack of effective conservation policies, or unique biodiversity hotspots.

B **Utilize Comprehensive Metrics**: While considering countries for focus, it's essential to utilize a comprehensive set of metrics beyond just forest coverage and deforestation rates. Factors such as biodiversity richness, the effectiveness of conservation policies, socio-economic impacts of deforestation, and potential for sustainable forest management should also be taken into account. By adopting a holistic approach, we can better assess the overall environmental significance and conservation needs of each country.

C **Target High-Impact Regions**: Focus efforts on regions or sub-national areas within priority countries that are experiencing particularly acute environmental challenges. This targeted approach allows for more effective allocation of resources and interventions where they are most urgently needed. Additionally, identifying high-impact regions enables us to tailor our strategies to address specific drivers of deforestation and promote sustainable land management practices at the local level.

D Engage Stakeholders and Partnerships: Collaboration with local governments, NGOs, research institutions, and community organizations is crucial for the success of our initiatives. By forming strategic partnerships with stakeholders at various levels, we can leverage their expertise, resources, and networks to implement more impactful interventions and foster greater ownership and support for forest conservation efforts.

E. Implement Evidence-Based Interventions: Ensure that our strategies and interventions are informed by robust scientific evidence and data-driven insights. Continuously monitor and evaluate the effectiveness of our initiatives, using indicators such as changes in forest cover, biodiversity indicators, and socio-economic outcomes to assess progress and adapt our approach as needed.

Based on these recommendations, our team should focus on countries and regions where our interventions can have the greatest positive impact on forest conservation and sustainable land management, while also fostering collaboration and partnerships with relevant stakeholders to maximize our effectiveness in achieving our goals.

5. APPENDIX: SQL Queries Used

```
/*-------------SQL PROJECT1-------------------------*/
/* Drop VIEW if it already exists */
Drop view if exists forestation;

----1.Creating a view called “Forestation”
/* Create VIEW  */
CREATE VIEW forestation AS
    SELECT
        r.region,
        l.year           AS lands_year,
        f.forest_area_sqkm,
        l.total_area_sq_mi,
        r.income_group,
        l.country_name   AS lands_country_name,
        f.country_name   AS forests_country_name,
        r.country_name   AS regions_country_name,
        f.country_code   AS forests_country_code,
        l.country_code   AS lands_country_code,
        r.country_code   AS regions_country_code,
        f.year           AS forests_year,
        ( f.forest_area_sqkm / 2.59 ) / l.total_area_sq_mi * 100 AS
percent_forest_area
    FROM
```

```
        forest_area   f
        INNER JOIN land_area     l ON f.country_code = l.country_code
                                  AND f.year = l.year
        INNER JOIN regions       r ON l.country_code = r.country_code;
/* End Create VIEW  */

----1.GLOBAL SITUATION-----------------------------------------------------------
---------------------
/* The query below results in the total forest area in sq km in the year 1990 */
/* Get country_name is World and have year 2016 or 1990 */
SELECT
    *
FROM
    forest_area
WHERE
    country_name = 'World'
    AND ( year = 2016
          OR year = 1990 );
-- country_code country_name    year    forest_area_sqkm
-- WLD          World           2016    39958245.9
-- WLD          World           1990    41282694.9
-- The above query yielded the result of 41282694.9 square kilometers for the
year 1990.
-- The above query yielded the result of 39958245.9 square kilometers for the
year 2016.

/* Get difference */
SELECT
    curr.forest_area_sqkm - prev.forest_area_sqkm AS difference
FROM
    forest_area AS curr JOIN forest_area as prev ON ( curr.year = '2016'
                                    AND prev.year = '1990'
                                        AND curr.country_name = 'World'
                                            AND prev.country_name = 'World' );
-- difference
-- -1324449

/* Get percent_forest_area */
SELECT
    100.0 * ( curr.forest_area_sqkm - prev.forest_area_sqkm ) /
prev.forest_area_sqkm AS percent_forest_area
FROM
    forest_area AS curr JOIN forest_area as prev ON ( curr.year = '2016'
                                    AND prev.year = '1990'
                                        AND curr.country_name = 'World'
```

```
                                                AND prev.country_name = 'World' );
-- percentage
-- -3.20824258980244

/* Get total_area_sqkm */
SELECT
    regions_country_name,
    ( total_area_sq_mi * 2.59 ) AS total_area_sqkm
FROM
    forestation
WHERE
    lands_year = 2016
ORDER BY
    total_area_sqkm;
-- Peru  1279999.9891

/* 2.   REGIONAL OUTLOOK */-------------------------------------------------------
-----------------------------------
/* Get the percent of the total land area of the world designated as forest was:
*/
SELECT
    percent_forest_area
FROM
    forestation
WHERE
    lands_year = 2016
    AND lands_country_name = 'World';
-- 31.3755709643095

/* Get all data with year 1990 and country is Workd */
SELECT
    *
FROM
    forestation
WHERE
    lands_year = 1990
    AND lands_country_name = 'World';
-- 32.4222035575689

/* Get region_forest_1990 and region_area_1990 */
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,
```

```sql
    region
FROM
    (
        SELECT
            SUM(a.forest_area_sqkm) region_forest_1990,
            SUM(a.total_area_sq_mi) region_area_1990,
            a.region,
            SUM(b.forest_area_sqkm) region_forest_2016,
            SUM(b.total_area_sq_mi) region_area_2016
        FROM
            forestation   a,
            forestation   b
        WHERE
            a.lands_year = '1990'
            AND a.lands_country_name != 'World'
            AND b.lands_year = '2016'
            AND b.lands_country_name != 'World'
            AND a.region = b.region
        GROUP BY
            a.region
    ) region_percent
ORDER BY
    forest_percent_1990 DESC;
-- forest_percent_1990 forest_percent_2016 region
-- 51.03               46.16               Latin America & Caribbean
-- 37.28               38.04               Europe & Central Asia
-- 35.65               36.04               North America
-- 30.67               28.79               Sub-Saharan Africa
-- 25.78               26.36               East Asia & Pacific
-- 16.51               17.51               South Asia
-- 1.78                2.07                Middle East & North Africa

/* 3.   COUNTRY-LEVEL DETAIL */-----------------------------------------------
---------------------------------------
SELECT
    curr.country_name,
    curr.forest_area_sqkm - prev.forest_area_sqkm AS difference
FROM
    forest_area AS curr
JOIN forest_area as prev ON ( curr.year = '2016'
                                    AND prev.year = '1990' )
                                   AND curr.country_name = prev.country_name
ORDER
    by difference desc;
-- China         527229.062
```

```sql
-- United States 79200
--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.

SELECT
    curr.country_name,
    100.0 * ( curr.forest_area_sqkm - prev.forest_area_sqkm ) /
prev.forest_area_sqkm AS percentage
FROM
    forest_area AS curr
JOIN forest_area as prev ON ( curr.year = '2016'
                                    AND prev.year = '1990' )
                                AND curr.country_name = prev.country_name
ORDER
    by percentage desc;
-- Iceland           213.664588870028
-- French Polynesia  181.818181818182
-- 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.

SELECT
    curr.country_name,
    curr.forest_area_sqkm - prev.forest_area_sqkm AS difference
FROM
    forest_area AS curr
JOIN forest_area as prev ON ( curr.year = '2016'
                                    AND prev.year = '1990' )
                                AND curr.country_name = prev.country_name
ORDER
    by difference;
-- Top 5 Amount Decrease in Forest Area by Country, 1990 & 2016
-- Brazil    -541510
-- Indonesia -282193.9844
-- Myanmar   -107234.0039
-- Nigeria   -106506.00098
-- Tanzania  -102320

SELECT
    curr.country_name,
    100.0 * ( curr.forest_area_sqkm - prev.forest_area_sqkm ) /
prev.forest_area_sqkm AS percentage
FROM
    forest_area AS curr
```

```
JOIN forest_area as prev ON ( curr.year = '2016'
                                    AND prev.year = '1990' )
                                  AND curr.country_name = prev.country_name
ORDER
    by percentage;
-- Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016
-- Togo         -75.4452559270073
-- Nigeria      -61.7999309388418
-- Uganda       -59.1286034729531
-- Mauritania   -46.7469879518072
-- Honduras     -45.0344149459194


SELECT DISTINCT
    ( quartiles ),
    COUNT(lands_country_name) OVER(
        PARTITION BY quartiles
    )
FROM
    (
        SELECT
            lands_country_name,
            CASE
                WHEN percent_forest_area <= 25 THEN
                    '0-25%'
                WHEN percent_forest_area <= 75
                     AND percent_forest_area > 50 THEN
                    '50-75%'
                WHEN percent_forest_area <= 50
                     AND percent_forest_area > 25 THEN
                    '25-50%'
                ELSE
                    '75-100%'
            END AS quartiles
        FROM
            forestation
        WHERE
            percent_forest_area IS NOT NULL
            AND lands_year = 2016
    ) quart;
--Count of Countries Grouped by Forestation Percent Quartiles, 2016
-- quartiles count
-- 0-25%     85
-- 25-50%    73
-- 50-75%    38
```

```sql
-- 75-100%   9

SELECT
    lands_country_name,
    percent_forest_area
FROM
    forestation
WHERE
    percent_forest_area > 75
    AND lands_year = 2016;
-- Top Quartile Countries, 2016
-- lands_country_name    percent_forest_area
-- American Samoa        87.5000875000875
-- Micronesia, Fed. Sts. 91.8572390715248
-- Gabon                 90.0376418700565
-- Guyana                83.9014489110682
-- Lao PDR               82.1082317640861
-- Palau                 87.6068085491204
-- Solomon Islands       77.8635177945066
-- Suriname              98.2576939676578
-- Seychelles            88.4111367385789
```