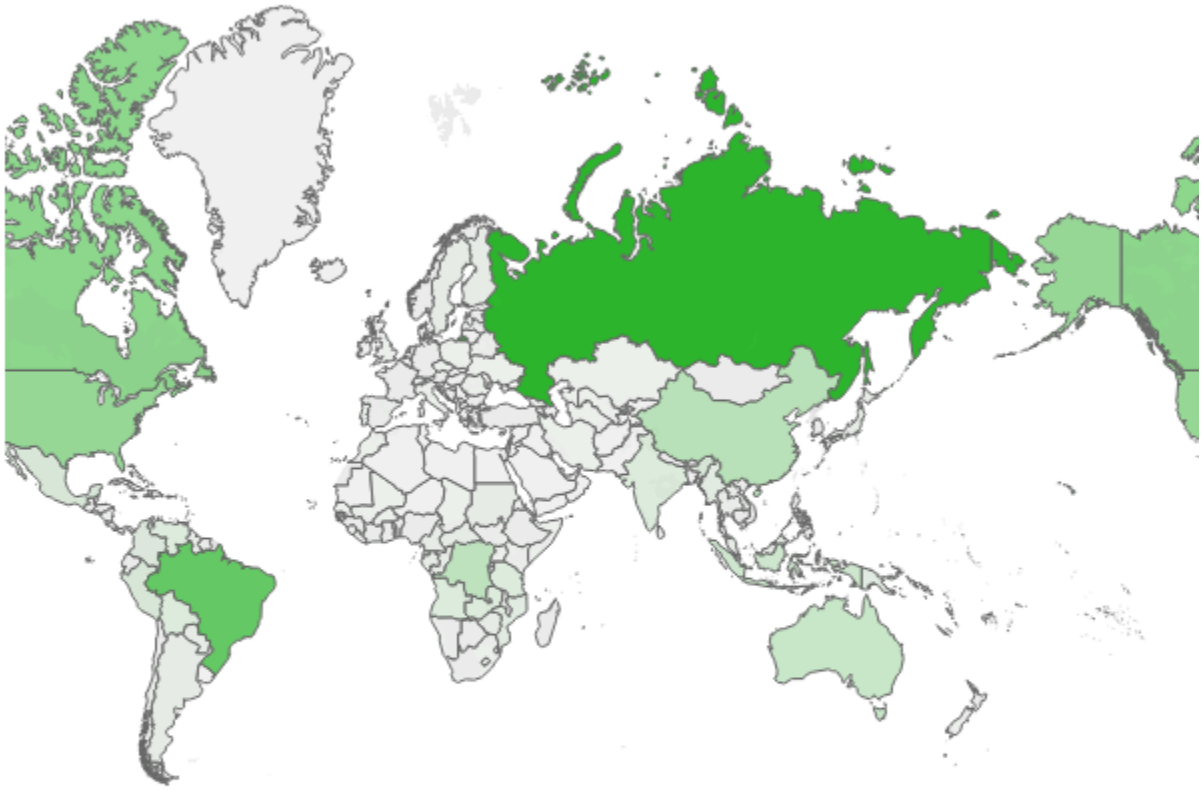
Deforestation Project



Presented to:

Eng. Yasser Abd-Elrahman

Group members:

- Ayoub Azez
- Alaa Elgafary
- Esraa Gamal
- Menna Elshamy
- Mohamed Tawab
- Saida Badawy

Deforestation poses one of the greatest challenges to global environmental sustainability. It not only threatens biodiversity but also accelerates climate change by reducing the planet's natural ability to absorb carbon dioxide. This project explores deforestation patterns and trends using SQL to analyze comprehensive datasets containing forest area, total land area, and regional affiliations.

By leveraging SQL, we aim to extract meaningful insights from data sources. The analysis focuses on understanding forest coverage trends over time, identifying regions with the highest and lowest forest preservation efforts, and comparing percentages of forested areas globally.

The project serves as a foundation for raising awareness about deforestation and driving discussions around successful strategies and urgent areas of concern. Through structured queries and well-designed tables, the data analysis aims to empower decision-makers, environmental organizations, and policymakers to make informed decisions for a sustainable future.

Part 1 - Global Situation

According to the dataset, the total forest area of the world was 41282694.9 km2 in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39958245.9 km2, a loss of 1324449 km2, or 3.21%.

The forest area lost over this time period is slightly more than the entire land area Peru listed for the year 2016 (which is 1280000 km2).

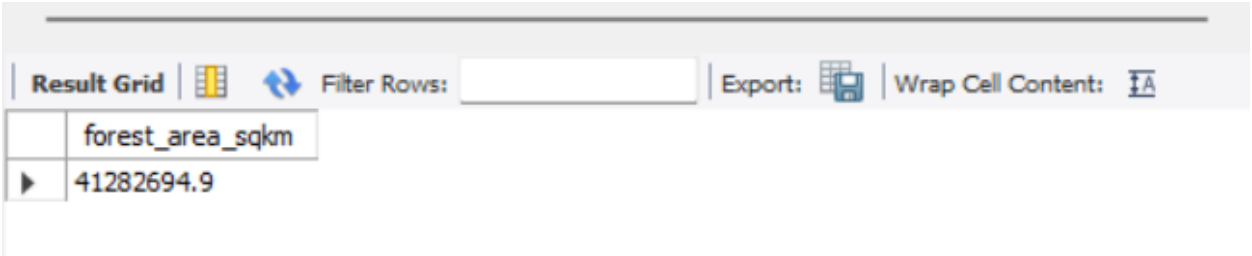
SQL queries used:

Create a View called “forestation” by joining all three tables - forest_area, land_area, and regions.

```
CREATE OR REPLACE VIEW forestation AS
SELECT
      f.country_name,
      f.country_code,
      f.year,
      f.forest_area_sqkm,
      (l.total_area_sq_mi*2.59) AS total_area,
      (f.forest_area_sqkm/(l.total_area_sq_mi*2.59))*100 AS
forest_area_perc,
      r.region AS region,
      r.income_group AS income
FROM forest_area AS f
JOIN land_area AS l
ON  f.country_code = l.country_code AND f.year = l.year
JOIN region AS r
ON l.country_code = r.country_code ;
```

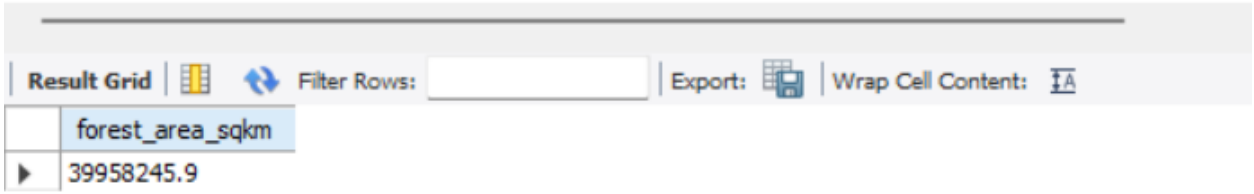
a. What was the total forest area (in sq km) of the world in 1990? Please keep in mind that you can use the country record denoted as “World" in the region table.

```
SELECT forest_area_sqkm
FROM forestation
WHERE country_name = 'World' AND year = '1990';
```



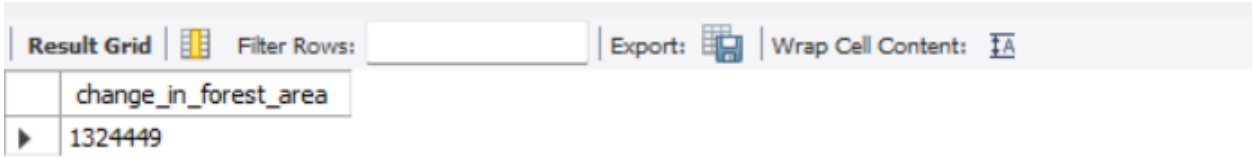
b. What was the total forest area (in sq km) of the world in 2016? Please keep in mind that you can use the country record in the table is denoted as “World.”

```
SELECT forest_area_sqkm
FROM forestation
WHERE country_name = 'World' AND year = '2016';
```



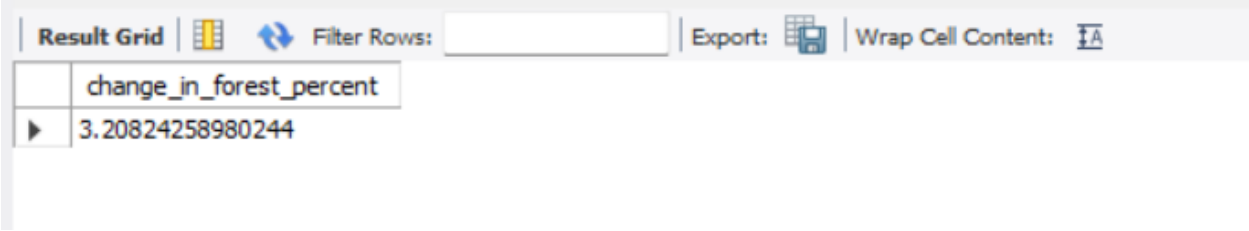
c. What was the change (in sq km) in the forest area of the world from 1990 to 2016?

```
WITH forest_2016 AS (
      SELECT forest_area_sqkm as f2016
      FROM forestation
      WHERE country_name = 'World' AND year = '2016')
SELECT forest_area_sqkm - f2016 AS change_in_forest_area
FROM forestation, forest_2016
WHERE country_name = 'World' AND year = '1990';
```



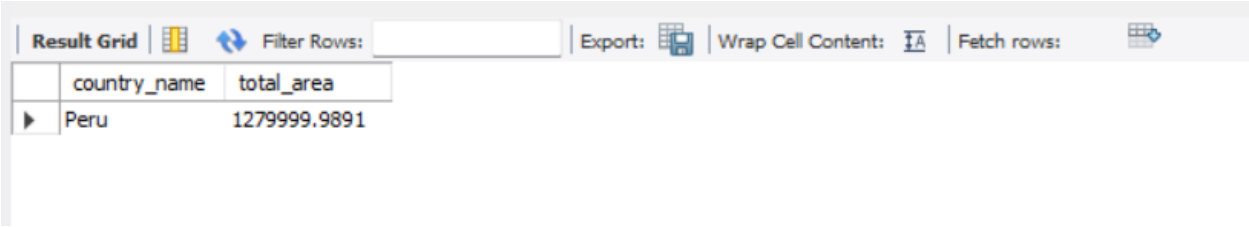
d. What was the percent change in forest area of the world between 1990 and 2016?

```
select ((forest_area_sqkm -
      ( select forest_area_sqkm
      from forestation
      where country_name='world' AND year = '2016'))/forest_area_sqkm)*100
AS change_in_forest_percent
from forestation
where country_name='world' AND year = '1990';
```



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
from forestation
order by
      abs(total_area
            - (SELECT forest_area_sqkm
                  - (SELECT forest_area_sqkm
                        FROM forestation
                        WHERE country_name = 'World' AND year = '2016')
                  FROM forestation
                  WHERE country_name = 'World' AND year = '1990'))
limit 1
```



Part 2: Regional Outlook

In 2016, the percentage 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.

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Sub-Saharan Africa (dropped from 30.67% to 28.79%) and Latin America & Caribbean (51.03% to 46.16%). 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%.

SQL queries used:

Create a table that shows the Regions and their percent forest area (sum of forest area divided by the sum of land area) in 1990 and 2016. (Note that 1 sq mi = 2.59 sq km).

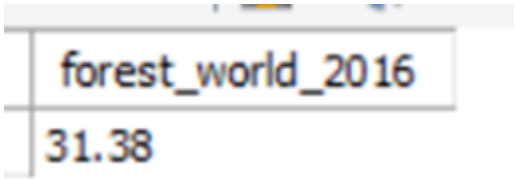
```
CREATE TABLE Region_Forest_Percentages AS
SELECT
    r.region,
    SUM(CASE WHEN f.year = 1990 THEN f.forest_area_sqkm ELSE 0 END) AS
total_forest_area_1990,
    SUM(CASE WHEN f.year = 1990 THEN l.total_area_sq_mi * 2.59 ELSE 0 END)
AS total_land_area_1990,
    SUM(CASE WHEN f.year = 2016 THEN f.forest_area_sqkm ELSE 0 END) AS
total_forest_area_2016,
    SUM(CASE WHEN f.year = 2016 THEN l.total_area_sq_mi * 2.59 ELSE 0 END)
AS total_land_area_2016,
    (SUM(CASE WHEN f.year = 1990 THEN f.forest_area_sqkm ELSE 0 END) /
     SUM(CASE WHEN f.year = 1990 THEN l.total_area_sq_mi * 2.59 ELSE 0 END)
* 100) AS percent_forest_area_1990,
    (SUM(CASE WHEN f.year = 2016 THEN f.forest_area_sqkm ELSE 0 END) /
     SUM(CASE WHEN f.year = 2016 THEN l.total_area_sq_mi * 2.59 ELSE 0 END)
* 100) AS percent_forest_area_2016
FROM
    forest_area AS f
JOIN
    land_area AS l ON f.country_code = l.country_code AND f.year = l.year
JOIN
    region AS r ON f.country_code = r.country_code
WHERE
    f.year IN (1990, 2016)
GROUP BY
```

```
    r.region;
```

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?

· Percent forest of the entire world in 2016 = 31.38 %

```
SELECT
    `percent_forest_area_2016` AS forest_world_2016
FROM
    `region_forest_percentages`
WHERE
    region = 'world';
```



forest_world_2016
31.38

Region had the HIGHEST percent forest in 2016 = 46.16 %

```
SELECT
    region AS highest_region_2016,
    ROUND(MAX(`percent_forest_area_2016`), 2) AS highest_forest_2016
FROM
    `region_forest_percentages`
GROUP BY
    region
ORDER BY
    2 DESC
LIMIT 1;
```

highest_region_2016	highest_forest_2016
Latin America & Caribbean	46.16

- Region had the LOWEST percent forest in 2016 = 2.7%

```
SELECT
    region AS lowest_region_2016,
    ROUND(MIN(`percent_forest_area_2016`), 2) AS lowest_forest_2016
FROM
    `region_forest_percentages`
GROUP BY
    region
ORDER BY
    2 ASC
LIMIT 1;
```

lowest_region_2016	lowest_forest_2016
Middle East & North Africa	2.07

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?

- The percent forest of the entire world in 1990 = 32.42 %

```
SELECT `percent_forest_area_1990` AS forest_world_1990
FROM `region_forest_percentages`
WHERE region = 'world';
```

forest_world_1990
32.42

· Region had the HIGHEST percent forest in 1990 = Latin America & Caribbean with 51.03 %

```
SELECT
    region AS highest_region_1990,
    ROUND(MAX(`percent_forest_area_1990`), 2) AS highest_forest_1990
FROM
    `region_forest_percentages`
GROUP BY
    region
ORDER BY
    2 DESC
LIMIT 1;
```

highest_region_1990	highest_forest_1990
Latin America & Caribbean	51.03

Region had the LOWEST percent forest in 1990 = Middle East & North Africa with 1.78 %

```
SELECT
    region AS lowest_region_1990,
    ROUND(MIN(`percent_forest_area_1990`), 2) AS lowest_forest_1990
FROM
    `region_forest_percentages`
GROUP BY
    region
ORDER BY
    2 ASC
LIMIT 1;
```

lowest_region_1990	LOWEST_forest_1990
Middle East & North Africa	1.78

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

· Regions of the world DECREASED in forest areas from 1990 to 2016

```
select
    region, round((percent_forest_area_1990 - percent_forest_area_2016),2)
    as percent_decrease
from region_forest_percentages
group by region, percent_forest_area_1990, percent_forest_area_2016
having round((percent_forest_area_1990 - percent_forest_area_2016),2) > 0
order by percent_decrease desc
```

region	percent_decrease
Latin America & Caribbean	4.87
Sub-Saharan Africa	3.34

Part 3 - Country-Level Detail

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 5 countries had the largest decrease in forest area over the time period under consideration: Brazil, Indonesia, Myanmar, Nigeria and Tanzania

The second way to consider which countries are of concern is to analyze the data by percent decrease. Top 5 Percent Decrease in Forest Area by Country, 1990 & 2016: Togo, Nigeria, Uganda, Mauritania and Honduras

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.

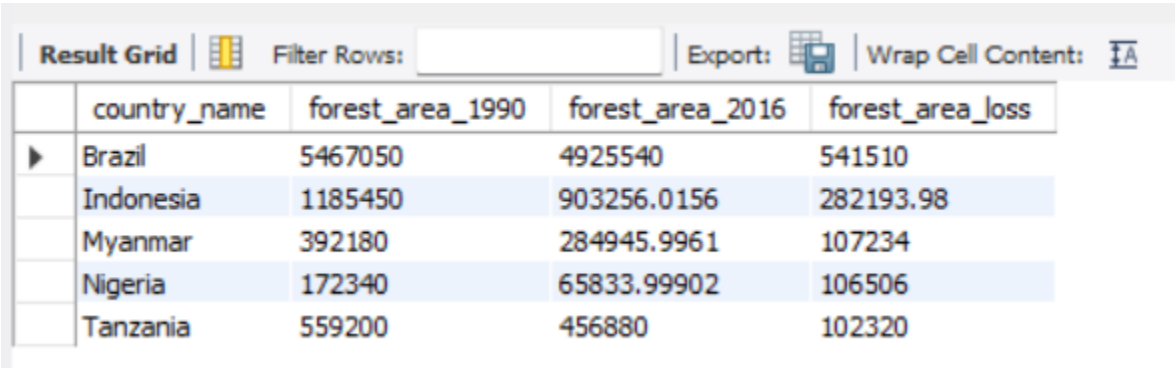
SQL queries used:

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?

```
WITH _1990 AS (
      SELECT
      ForestArea AS forest_area_1990,
      CountryName,
      Year
      FROM
      forestation
      WHERE
      Year = 1990
),
_2016 AS (
      SELECT
      ForestArea AS forest_area_2016,
      CountryName,
      Year
      FROM
      forestation
      WHERE
      Year = 2016
)
SELECT
      _1990.CountryName,
      _1990.forest_area_1990,
      _2016.forest_area_2016,
      round((_1990.forest_area_1990 - _2016.forest_area_2016),2) AS
forest_area_loss

FROM
      _1990
LEFT JOIN
```

```
      _2016
      ON _1990.CountryName = _2016.CountryName
where _1990.CountryName !='world'
ORDER BY
      forest_area_loss DESC
LIMIT 5;
```



Result Grid | Filter Rows: | Export: | Wrap Cell Content:

country_name	forest_area_1990	forest_area_2016	forest_area_loss
Brazil	5467050	4925540	541510
Indonesia	1185450	903256.0156	282193.98
Myanmar	392180	284945.9961	107234
Nigeria	172340	65833.99902	106506
Tanzania	559200	456880	102320

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?

```
WITH _1990 AS (
      SELECT
      forest_area_sqkm AS forest_area_1990,
      country_name,
        region,
      Year
      FROM
      forestation
      WHERE
      Year = 1990
),
_2016 AS (
      SELECT
      forest_area_sqkm AS forest_area_2016,
      country_name,
      Year
      FROM
      forestation
      WHERE
      Year = 2016
)
```

```sql
SELECT
      _1990.country_name,
    _1990.region,
      _1990.forest_area_1990,
      _2016.forest_area_2016,
    ROUND(((((_1990.forest_area_1990-_2016.forest_area_2016)
/_1990.forest_area_1990 )) * 100) , 2) AS change_prc


FROM
      _1990
JOIN
      _2016
      ON _1990.country_name = _2016.country_name
where _1990.country_name !='world' AND _2016.forest_area_2016 <
_1990.forest_area_1990
ORDER BY
      change_prc DESC
LIMIT 5;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

country_name	region	forest_area_1990	forest_area_2016	change_prc
Togo	Sub-Saharan Africa	6850	1681.999969	75.45
Nigeria	Sub-Saharan Africa	172340	65833.99902	61.8
Uganda	Sub-Saharan Africa	47510	19418.00049	59.13
Mauritania	Sub-Saharan Africa	4150	2210	46.75
Honduras	Latin America & Caribbean	81360	44720	45.03

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

```sql
SELECT
      COUNT(*) AS countries_with_higher_forestation
FROM
      forestation
WHERE
      Year = 2016

      AND ROUND((ForestArea / TotalLandArea) * 100, 2) > (
      SELECT
```

```
        ROUND((ForestArea / TotalLandArea) * 100, 2)
    FROM
        forestation
    WHERE
        Year = 2016
        AND CountryName = 'United States'
    );
```

Results and Findings

- Significant deforestation observed in developing regions.
- High-income countries show stable or increasing forest cover.
- Correlation between economic development and deforestation rates.

Conclusion

The analysis reveals that economic and regional factors play a crucial role in deforestation trends. Effective policies targeting sustainable land use are essential for reversing deforestation impacts

Appendix:

Link of colab notebook:

Deforestation Project.ipynb