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 sq km** in 1990. As of 2016, the most recent year for which data was available, that number had fallen to **39958245.9 sq km**, a loss of **1324449 sq km**, or **-3.21%**.

The forest area lost over this time period is slightly more than the entire land area of **Monaco** listed for the year 2016 (which is **1.9943 sq km**).

2. **REGIONAL OUTLOOK**

In 2016, the percent of the total land area of the world designated as forest was **31.34%**. 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 **32.21%**.The region with the highest relative forestation was **Latin America & Caribbean**, with **51.03%**, and the region with the lowest relative forestation **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
World	**32.21%**	**31.34%**

Latin America & Caribbean	**51.03%**	**46.16%**
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 **32.21%** to **31.34%**.

3. **COUNTRY-LEVEL DETAIL**

A. SUCCESS STORIES

There is one particularly bright spot in the data at the country level, **Solomon Islands**. This country actually increased in forest area from 1990 to 2016 by **1324449 hectares**. 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 **Brazil**, but it only saw an increase of **541510 hectares**, much lower than the figure for **Solomon Islands**.

Solomon Islands and **Brazil** 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. **St. Martin (French part)** increased in forest area by **100.00%** 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
World	**World**	**1324449**
Indonesia	**East Asia & Pacific**	**282193.98**
Myanmar	**East Asia & Pacific**	**107234.00**

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
St. Martin (French part)	**Latin America & Caribbean**	**100.00**
Togo	**Sub-Saharan Africa**	**75.45**
Nigeria	**Sub-Saharan Africa**	**61.80**

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 **ogo**, **Nigeria**, **Uganda**, and **Mauritania**. The 5th country on the list is **St. Martin (French part),** 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
1	**55**
2	**55**
3	**45**
4	**45**

The largest number of countries in 2016 were found in the **1st and 2nd** quartile.

There were **55** 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
Solomon Islands	**East Asia & Pacific**	**>75**
Lao PDR	**East Asia & Pacific**	**>75**
Guyana	**Latin America & Caribbean**	**>75**

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?*

From the World Bank data, I have learned that between 1990 and 2016, many countries experienced significant decreases in forest areas. This loss is particularly severe in regions such as Sub-Saharan Africa, with countries like Togo and Nigeria showing notable reductions. The Latin America and Caribbean region also faces severe forest loss, as seen in places like St. Martin (French part). On the positive side, some countries still maintain high forest coverage, especially in regions like East Asia & Pacific and Sub-Saharan Africa.
Based on the data, we should focus on countries like Nigeria, Indonesia, Togo, St. Martin (French part), and Uganda. Nigeria has lost a lot of its forests, so it needs reforestation and efforts to stop deforestation. Indonesia also has a large decrease in forest area and needs urgent reforestation and stricter regulations. Togo's big loss in forest area means it needs sustainable forest management practices. St. Martin (French part) has completely lost its forest area, so we need to understand the causes and work on reforestation. Uganda's significant deforestation highlights the need for effective policies and community involvement to stop further loss. By focusing on these countries, we can have a significant impact on reversing deforestation trends and promoting better forest management.

5. APPENDIX: SQL Queries Used

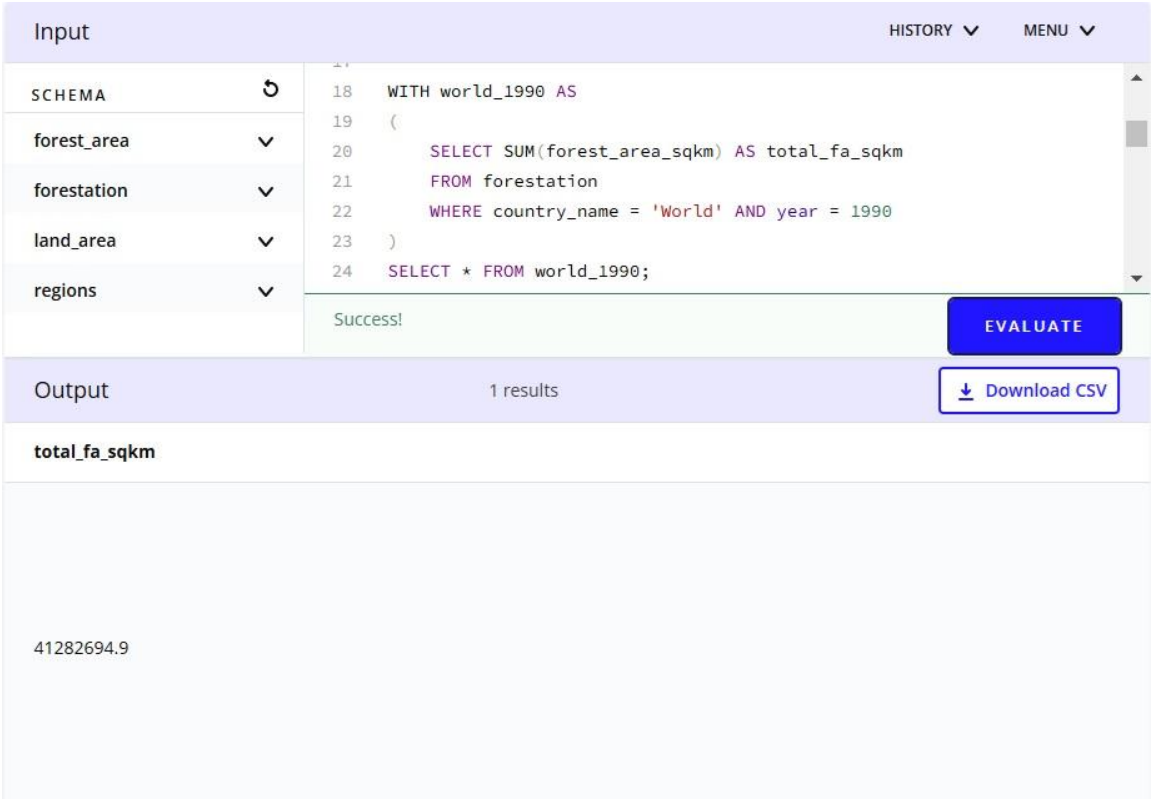
```
CREATE VIEW forestation AS
SELECT
  fa.country_code,
  fa.country_name,
  fa.year,
```

```
   COALESCE(fa.forest_area_sqkm, 0) AS forest_area_sqkm,
   COALESCE(la.total_area_sq_mi, 0) AS total_area_sq_mi,
   r.region,
   COALESCE(r.income_group, 'Unknown') AS income_group,
   ((fa.forest_area_sqkm / (la.total_area_sq_mi * 2.59)) * 100) AS percent_fa
FROM
    forest_area AS fa
JOIN
    land_area AS la
ON fa.country_code = la.country_code  AND  fa.year = la.year
JOIN
    Regions AS r
ON fa.country_code = r.country_code;
```

PART 1 –GLOBAL SITUATION

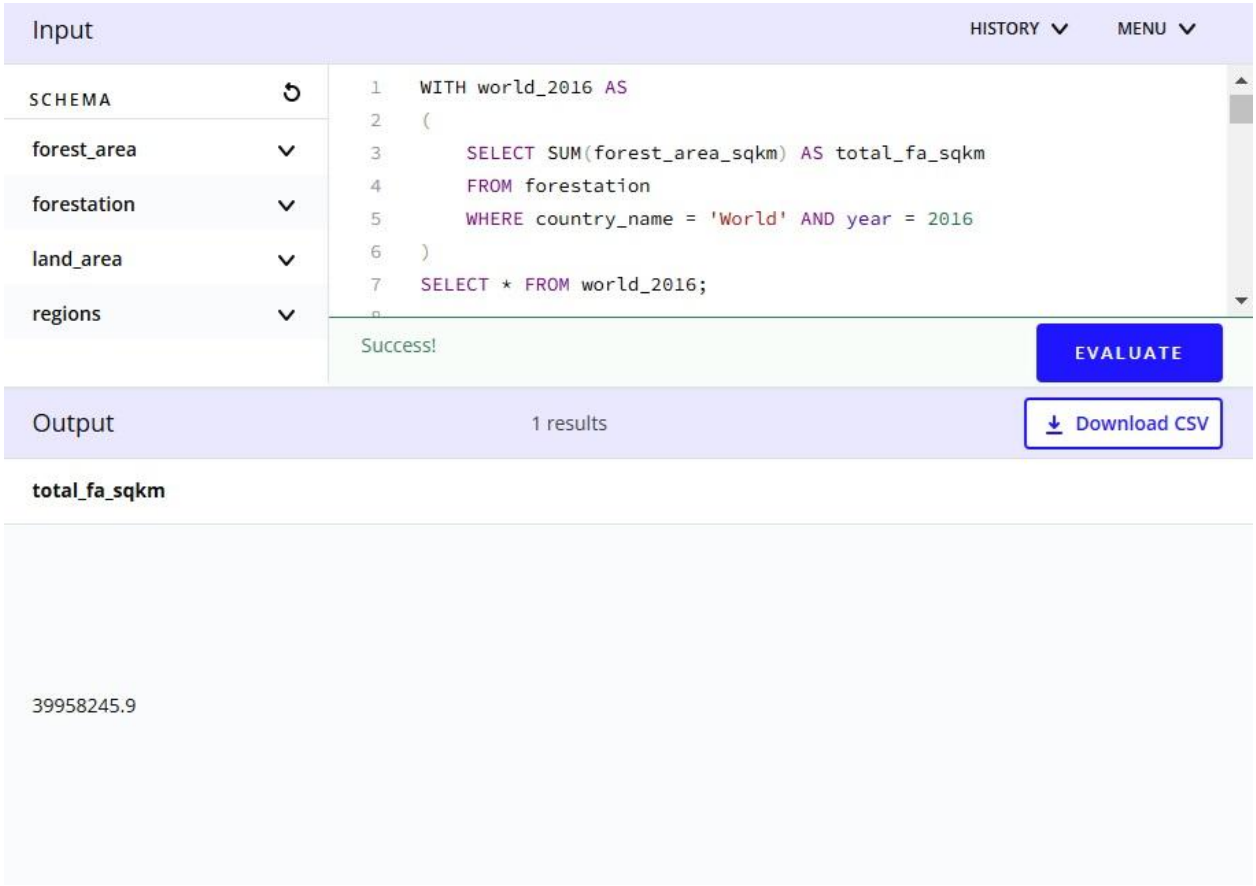
(a)

```
WITH world_1990 AS
(
    SELECT SUM(forest_area_sqkm) AS total_fa_sqkm
    FROM forestation
    WHERE country_name = 'World' AND year = 1990)
SELECT * FROM world_1990;
```



(b)

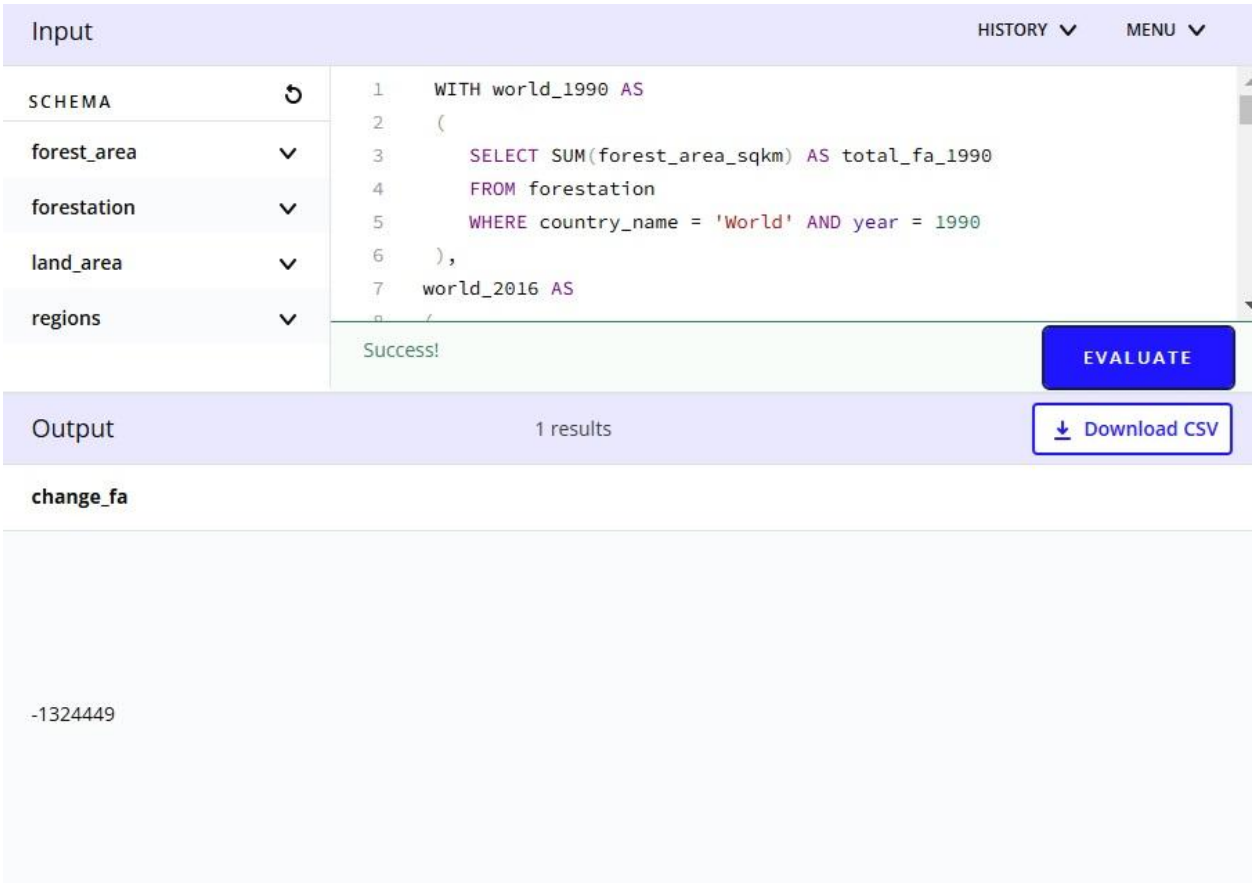
```
WITH world_2016 AS
(
   SELECT SUM(forest_area_sqkm) AS total_fa_sqkm
   FROM forestation
   WHERE country_name = 'World' AND year = 2016
)
SELECT * FROM world_2016;
```



(c)

```
WITH world_1990 AS
(
   SELECT SUM(forest_area_sqkm) AS total_fa_1990
   FROM forestation
   WHERE country_name = 'World' AND year = 1990
),
world_2016 AS
(
   SELECT SUM(forest_area_sqkm) AS total_fa_2016
   FROM forestation
   WHERE country_name = 'World' AND year = 2016
```

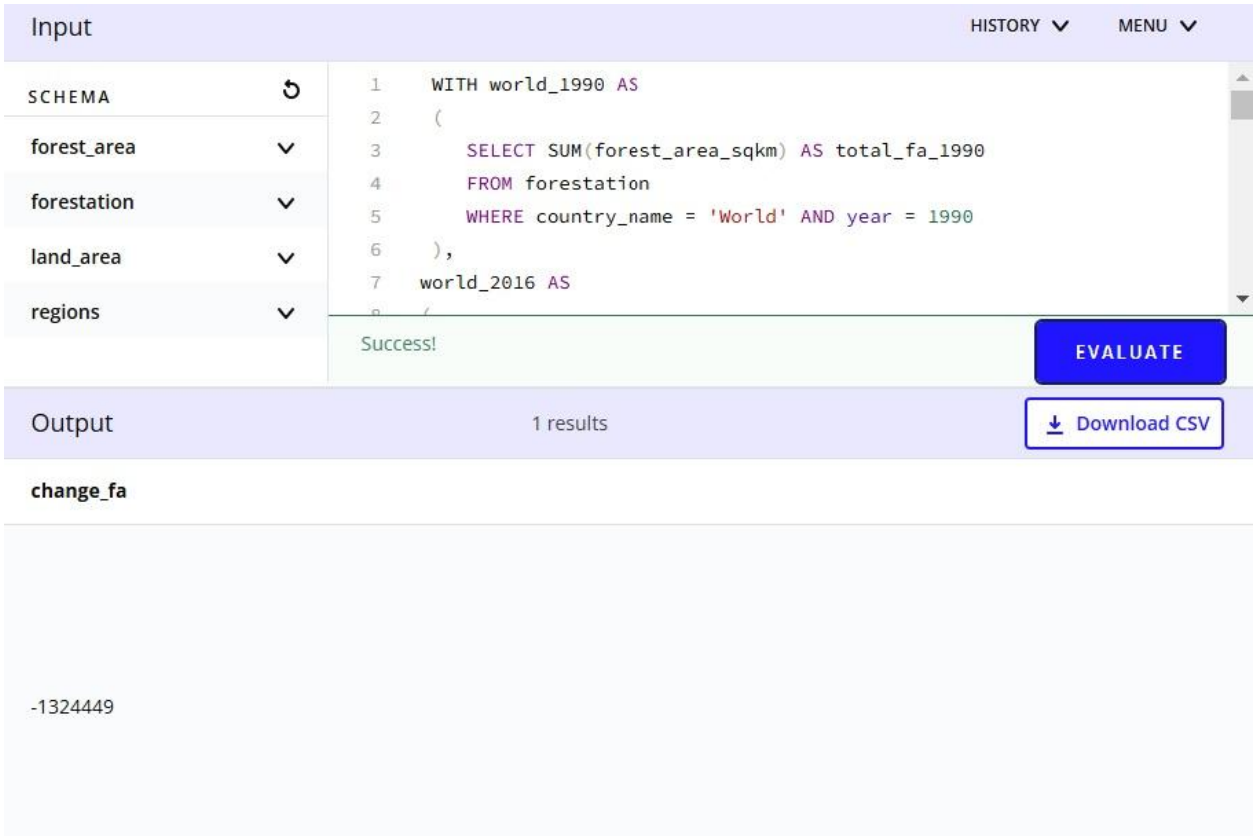
)
SELECT
(SELECT total_fa_2016
FROM world_2016) - (SELECT total_fa_1990
FROM world_1990) AS change_fa;



(d)

```
WITH world_1990 AS
 (
   SELECT SUM(forest_area_sqkm) AS total_fa_1990
   FROM forestation
   WHERE country_name = 'World' AND year = 1990
),
world_2016 AS
(
   SELECT SUM(forest_area_sqkm) AS total_fa_2016
   FROM forestation
   WHERE country_name = 'World' AND year = 2016
)
SELECT
```

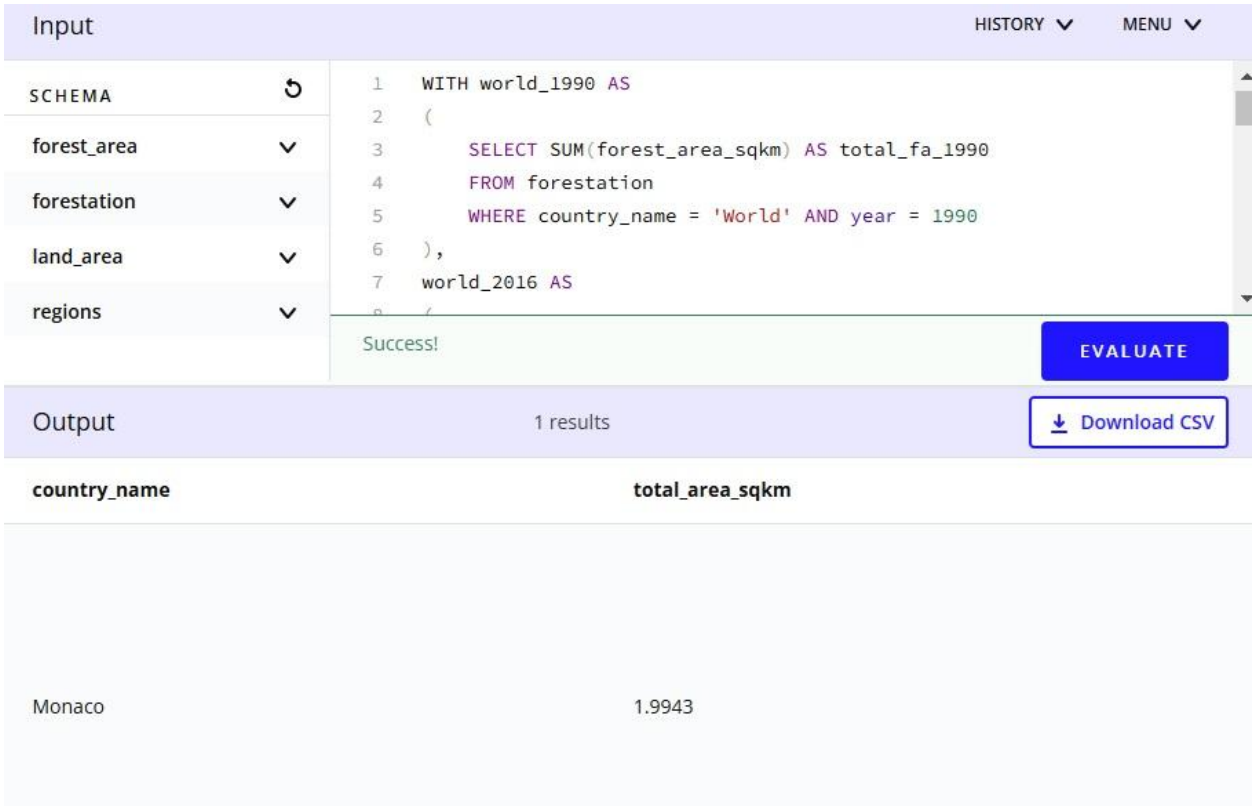
((SELECT total_fa_2016 FROM world_2016) -
(SELECT total_fa_1990 FROM world_1990)) * 100.0 /
(SELECT total_fa_1990 FROM world_1990) AS percent_change;



(e)

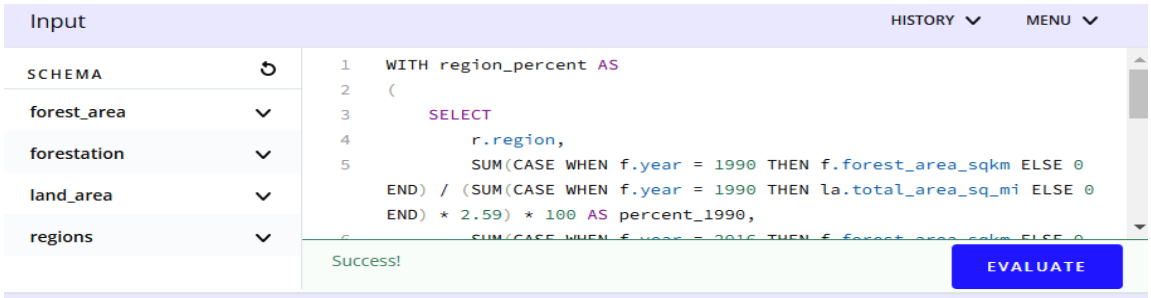
```
WITH world_1990 AS
(
   SELECT SUM(forest_area_sqkm) AS total_fa_1990
   FROM forestation
   WHERE country_name = 'World' AND year = 1990
),
world_2016 AS
(
   SELECT SUM(forest_area_sqkm) AS total_fa_2016
   FROM forestation
   WHERE country_name = 'World' AND year = 2016
),
fa_change AS
(
   SELECT
      (SELECT total_fa_2016 FROM world_2016) -
      (SELECT total_fa_1990 FROM world_1990) AS fa_lost
),
```

```
country_areas AS
(
    SELECT
        country_name,
        COALESCE(total_area_sq_mi * 2.59, 0) AS total_area_sqkm
    FROM forestation
    WHERE year = 2016 AND COALESCE(total_area_sq_mi, 0) > 0
)
SELECT
    country_name,
    total_area_sqkm
FROM
    country_areas,
    fa_change
ORDER BY
    CASE
        WHEN (fa_lost - total_area_sqkm) < 0 THEN (total_area_sqkm - fa_lost)
        ELSE (fa_lost - total_area_sqkm)
    END
LIMIT 1;
```



PART 2- REGIONAL OUTLOOK

```
WITH region_percent AS
(
   SELECT
        r.region,
        SUM(CASE WHEN f.year = 1990 THEN f.forest_area_sqkm ELSE 0 END) /
(SUM(CASE WHEN f.year = 1990 THEN la.total_area_sq_mi ELSE 0 END) * 2.59) *
100 AS percent_1990,
        SUM(CASE WHEN f.year = 2016 THEN f.forest_area_sqkm ELSE 0 END) /
(SUM(CASE WHEN f.year = 2016 THEN la.total_area_sq_mi ELSE 0 END) * 2.59) *
100 AS percent_2016
   FROM
      forestation AS f
   JOIN
      land_area la
  ON f.country_code = la.country_code AND f.year = la.year
   JOIN
      Regions AS r
   ON f.country_code = r.country_code
   GROUP BY
      r.region
)
SELECT * FROM region_percent;
```

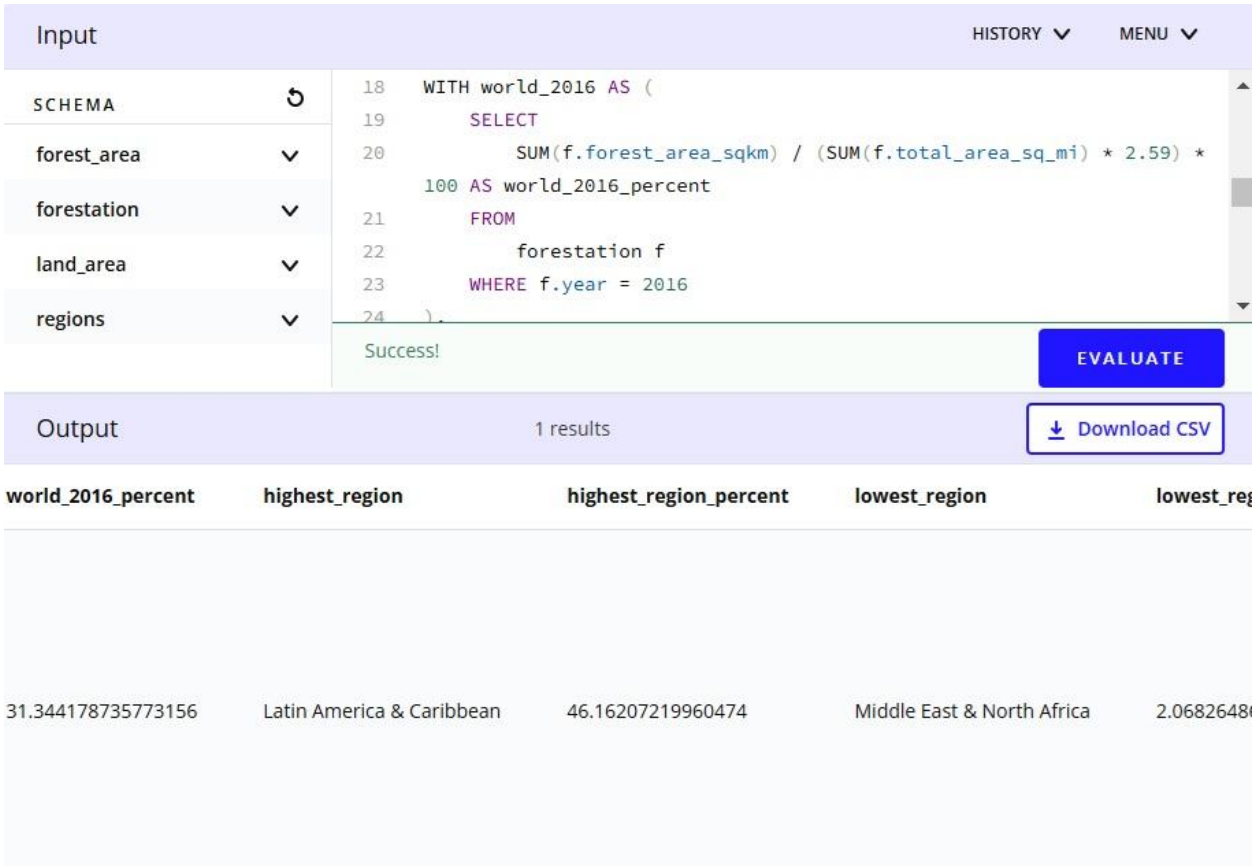


Output — 8 results — Download CSV

region	percent_1990	percent_2016
East Asia & Pacific	25.77609539731745	26.3586765000485
World	32.42220355756894	31.375570964309528
Middle East & North Africa	1.7752406246935268	2.0682648687150125
Europe & Central Asia	37.28393985640194	38.04142160325166
Latin America & Caribbean	51.02997986675144	46.16207219960474
North America	35.651179000901536	36.03936096814378
Sub-Saharan Africa	30.674145461000617	28.788188355046408
South Asia	16.51076700142095	17.505863408153374

(a)

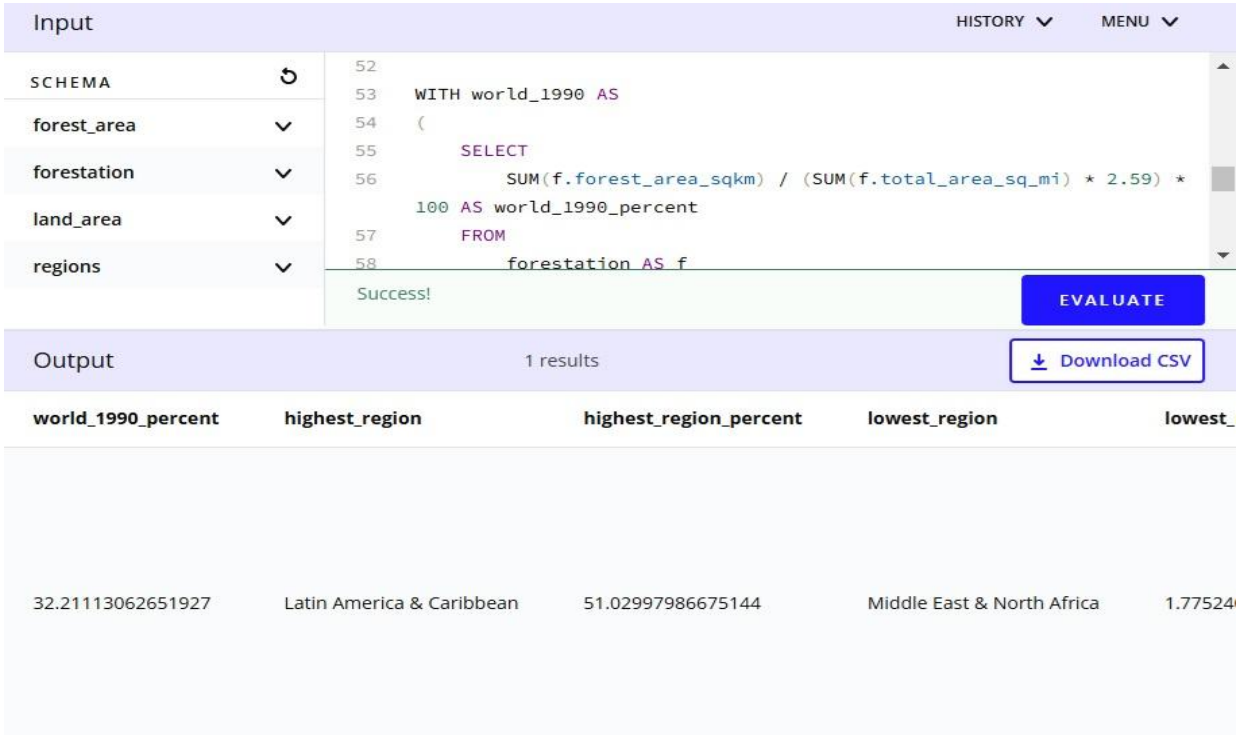
```
WITH world_2016 AS
 (
   SELECT
      SUM(f.forest_area_sqkm) / (SUM(f.total_area_sq_mi) * 2.59) * 100 AS
world_2016_percent
   FROM
      forestation  AS f
   WHERE f.year = 2016
),
region_2016 AS
 (
   SELECT
      f.region,
      SUM(f.forest_area_sqkm) / (SUM(f.total_area_sq_mi) * 2.59) * 100 AS
region_2016_percent
   FROM
      forestation AS f
   WHERE f.year = 2016
   GROUP BY f.region
)
SELECT
   w.world_2016_percent,
   highest.region AS highest_region,
   highest.region_2016_percent AS highest_region_percent,
   lowest.region AS lowest_region,
   lowest.region_2016_percent AS lowest_region_percent
FROM
   world_2016 AS w,
   (SELECT region, region_2016_percent
    FROM region_2016 ORDER BY region_2016_percent  DESC
    LIMIT 1) AS highest,
   (SELECT region, region_2016_percent
     FROM region_2016
    ORDER BY region_2016_percent  ASC
    LIMIT 1) AS lowest;
```



(b)

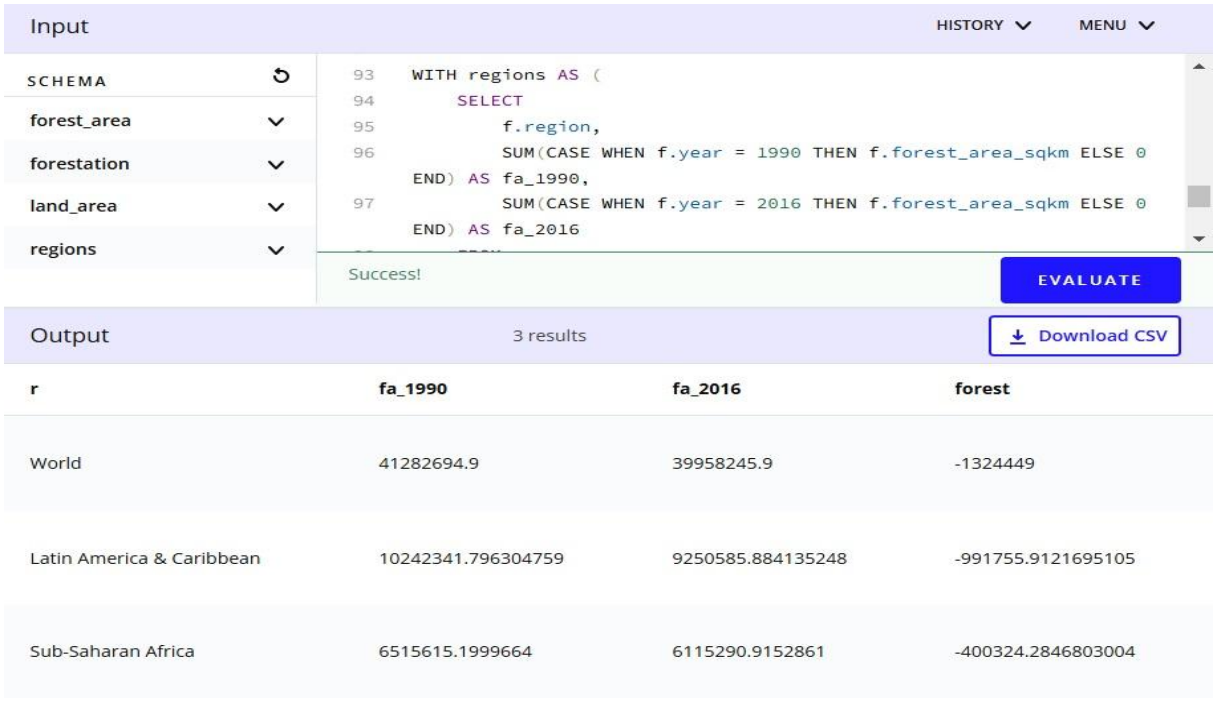
```
WITH world_1990 AS
(
   SELECT
      SUM(f.forest_area_sqkm) / (SUM(f.total_area_sq_mi) * 2.59) * 100 AS
world_1990_percent
   FROM
      forestation AS f
   WHERE f.year = 1990
),
region_1990 AS
(
   SELECT
      f.region,
      SUM(f.forest_area_sqkm) / (SUM(f.total_area_sq_mi) * 2.59) * 100 AS
region_1990_percent
   FROM
      forestation AS f
   WHERE f.year = 1990
   GROUP BY f.region
```

```
)
SELECT
    w.world_1990_percent,
    highest.region AS highest_region,
    highest.region_1990_percent AS highest_region_percent,
    lowest.region AS lowest_region,
    lowest.region_1990_percent AS lowest_region_percent
FROM
    world_1990 AS w,
    (
      SELECT region, region_1990_percent
      FROM region_1990
      ORDER BY region_1990_percent DESC
      LIMIT 1
     ) AS highest,
    (
      SELECT region, region_1990_percent
      FROM region_1990
      ORDER BY region_1990_percent ASC
      LIMIT 1
     )AS lowest;
```



(c)

```
WITH regions AS
(
   SELECT
      f.region,
      SUM(CASE WHEN f.year = 1990 THEN f.forest_area_sqkm ELSE 0 END) AS
fa_1990,
      SUM(CASE WHEN f.year = 2016 THEN f.forest_area_sqkm ELSE 0 END) AS
fa_2016
   FROM
      forestation AS f
   GROUP BY
      f.region
)
SELECT
   regions.region AS r,
   regions.fa_1990 AS fa_1990,
   regions.fa_2016 AS fa_2016,
   regions.fa_2016 - regions.fa_1990 AS forest
FROM
   regions
WHERE
   regions.fa_2016 < regions.fa_1990;
```



PART 3 – COUNTRY LEVEL

(a)

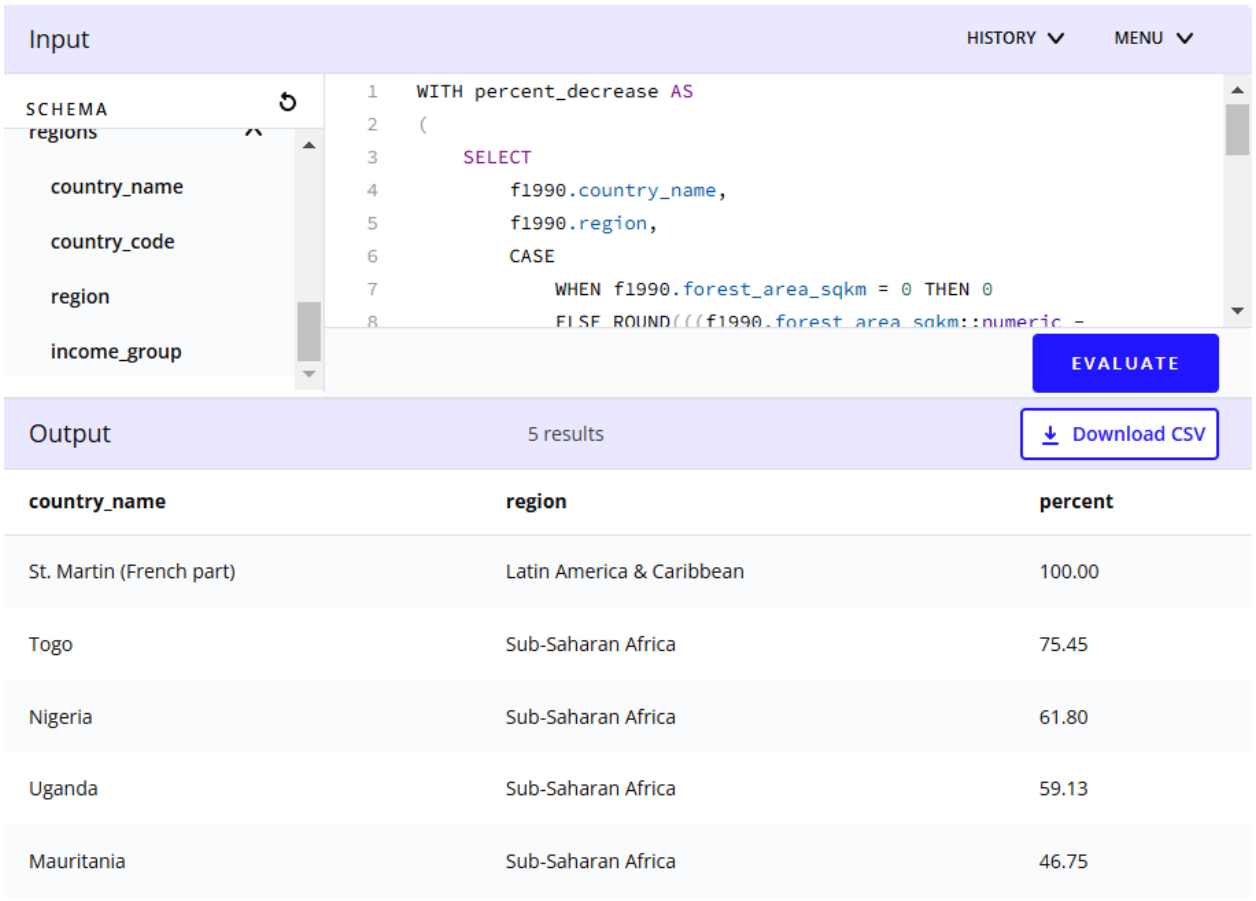
```
WITH forest AS (
    SELECT
        f1990.country_name,
        f1990.region,
        (f1990.forest_area_sqkm - f2016.forest_area_sqkm) AS forest_area
    FROM
        forestation AS f1990
    JOIN
        forestation AS f2016
        ON f1990.country_code = f2016.country_code
        AND f1990.year = 1990
        AND f2016.year = 2016)
SELECT
    country_name,
    region,
    forest_area
FROM
    forest
ORDER BY
    forest_area DESC
LIMIT 5;
```

Output — 5 results — Download CSV

country_name	region	forest_area
World	World	1324449
Brazil	Latin America & Caribbean	541510
Indonesia	East Asia & Pacific	282193.98439999996
Myanmar	East Asia & Pacific	107234.00390000001
Nigeria	Sub-Saharan Africa	106506.00098

(b)

```
WITH percent_decrease AS
(
    SELECT
        f1990.country_name,
        f1990.region,
        CASE
            WHEN f1990.forest_area_sqkm = 0 THEN 0
            ELSE ROUND(((f1990.forest_area_sqkm::numeric -
f2016.forest_area_sqkm::numeric) / f1990.forest_area_sqkm::numeric) * 100, 2)
        END AS percent
    FROM
        forestation AS f1990
    JOIN
        forestation AS f2016
        ON f1990.country_code = f2016.country_code
        AND f1990.year = 1990
        AND f2016.year = 2016
)
SELECT
    country_name,
    region,
    percent
FROM
    percent_decrease
ORDER BY
    percent DESC
LIMIT 5;
```



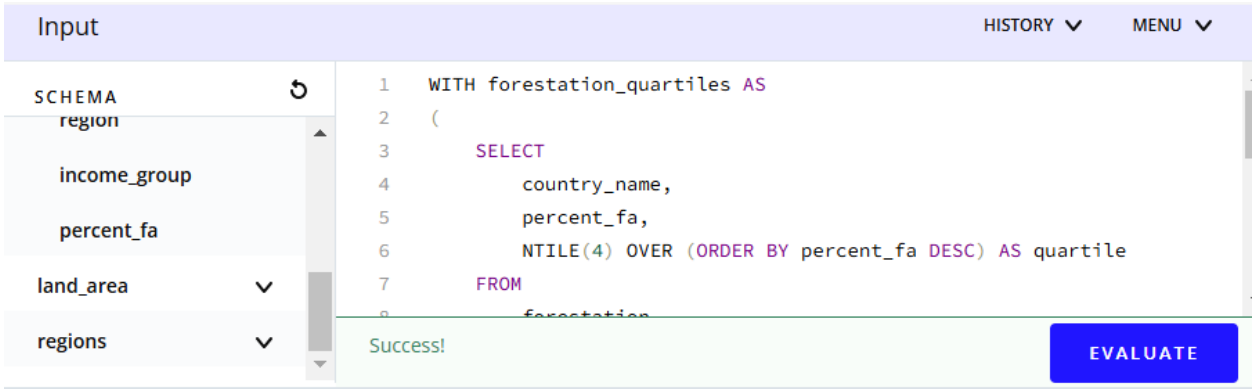
country_name	region	percent
St. Martin (French part)	Latin America & Caribbean	100.00
Togo	Sub-Saharan Africa	75.45
Nigeria	Sub-Saharan Africa	61.80
Uganda	Sub-Saharan Africa	59.13
Mauritania	Sub-Saharan Africa	46.75

(c)

```
WITH forestation_quartiles AS
(
    SELECT
        country_name,
        percent_fa,
        NTILE(4) OVER (ORDER BY percent_fa DESC) AS quartile
    FROM
        forestation
    WHERE
        year = 2016
)

SELECT
    quartile,
    COUNT(country_name) AS countries
FROM
```

```
    forestation_quartiles
GROUP BY
    quartile
ORDER BY
    quartile;
```



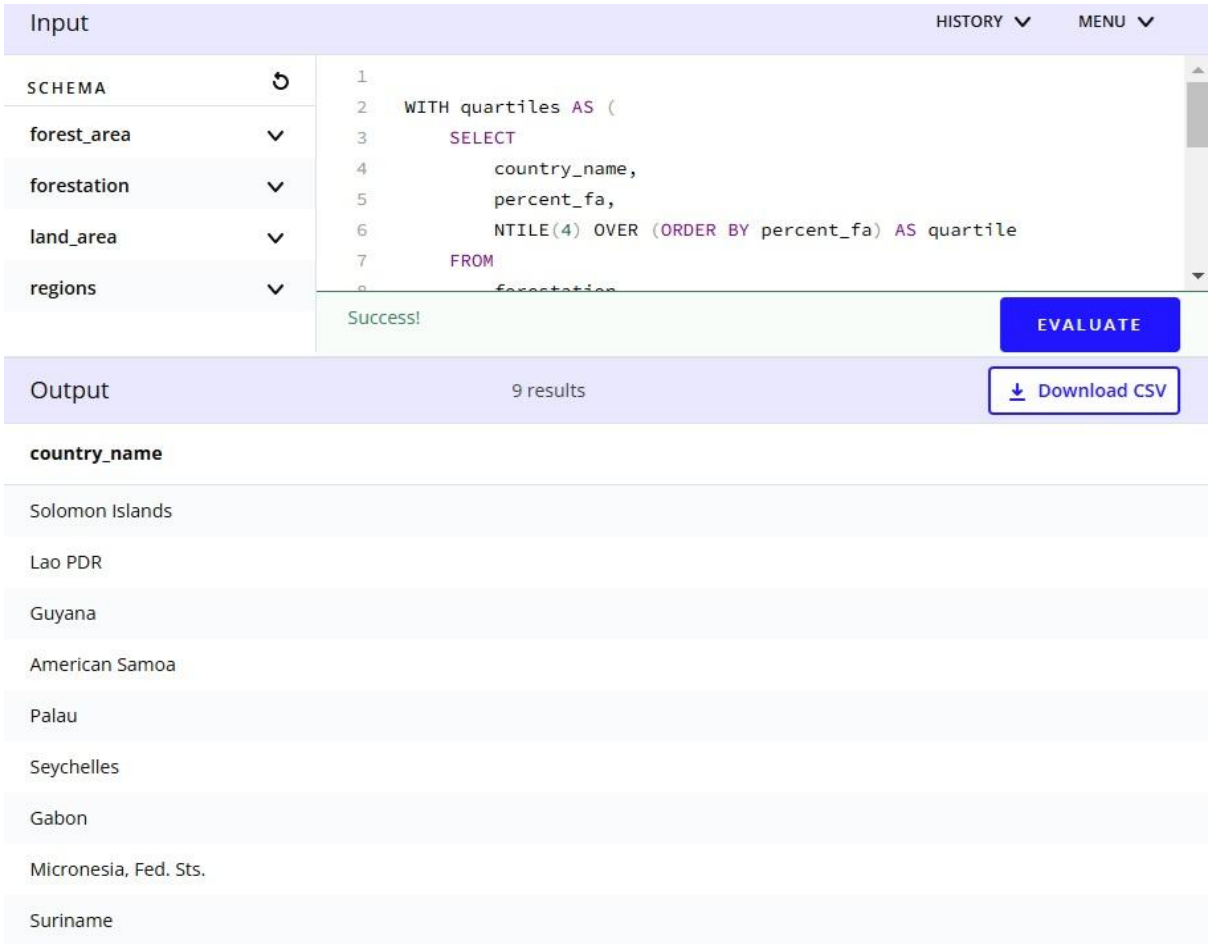
Output 4 results Download CSV

quartile	countries
1	55
2	55
3	54
4	54

(d)

```
WITH quartiles AS (
    SELECT
        country_name,
        percent_fa,
        NTILE(4) OVER (ORDER BY percent_fa) AS quartile
    FROM
        forestation
    WHERE
        year = 2016
)
SELECT
```

```
    country_name
FROM
    quartiles
WHERE
    quartile = 4
    AND percent_fa > 75;
```



(e)

```
WITH forestation_US AS (
    SELECT
        percent_fa
    FROM
        forestation
    WHERE
        country_name = 'United States'
        AND year = 2016),
higher AS (
    SELECT
        country_name
```

```
    FROM
        forestation, forestation_US
    WHERE
        forestation.percent_fa > forestation_US.percent_fa
        AND forestation.year = 2016)
SELECT
    COUNT(*) AS counteries
FROM
    higher;
```