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 41,282,695 km^2 in 1990. As of 2016, the most recent year for which data was available, that number had fallen to 39,958,246 km^2, a loss of -1,324,449 km^2, 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 1,280,000 km^2).

2. **REGIONAL OUTLOOK**

In 2016, the percent of the total land area of the world designated as forest was 31,4%. The region with the highest relative forestation was Latin America & Carribean, with 46,2%, and the region with the lowest relative forestation was Middle East & North Africa, with 2,1% forestation.

In 1990, the percent of the total land area of the world designated as forest was 32,4%. The region with the highest relative forestation was Latin America & Carribean, with 51%, and the region with the lowest relative forestation was Middle East & North Africa, with 1,8% forestation.

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

Region	1990 Forest Percentage	2016 Forest Percentage
Latin America & Carribean	51%	46,2%
Europe & Central Asia	37,3%	38%
North America	35,7%	36%
World	32,4%	31,4%
Sub-Saharan Africa	30,7%	28,8%
East Asia & Pacific	25,8%	26,4%
South Asia	16,5%	17,5%
Middle East & North Africa	1,8%	2,1%

The only regions of the world that decreased in percent forest area from 1990 to 2016 were Latin America & Carribean (dropped from 51% to 46,2%) and Sub-Saharan Africa (30,7% to 28,8%). 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 32,4% to 31,4%.

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 km^2. 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 km^2, 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 213,7% 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 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, Nigeria, Uganda, and Mauritania. The 5th country on the list is Honduras, which is in the Latin America & Carribean 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
1st Quartile (0-25%)	85
2nd Quartile (25-50%)	72
3rd Quartile (50-75%)	38
4th Quartile (>75%)	9

The largest number of countries in 2016 were found in the 1st 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%

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?*

Deforestation remains a significant global issue, particularly in developing nations. Since 1990, key emerging economies such as Brazil, Indonesia, Pakistan, and Nigeria have experienced notable reductions in their forest cover. In addition, various smaller countries in regions like Sub-Saharan Africa and the Latin America & Caribbean are continuing to lose forests at troubling rates. Conversely, many developed nations and some emerging markets have begun to turn this trend around by expanding their forested areas.

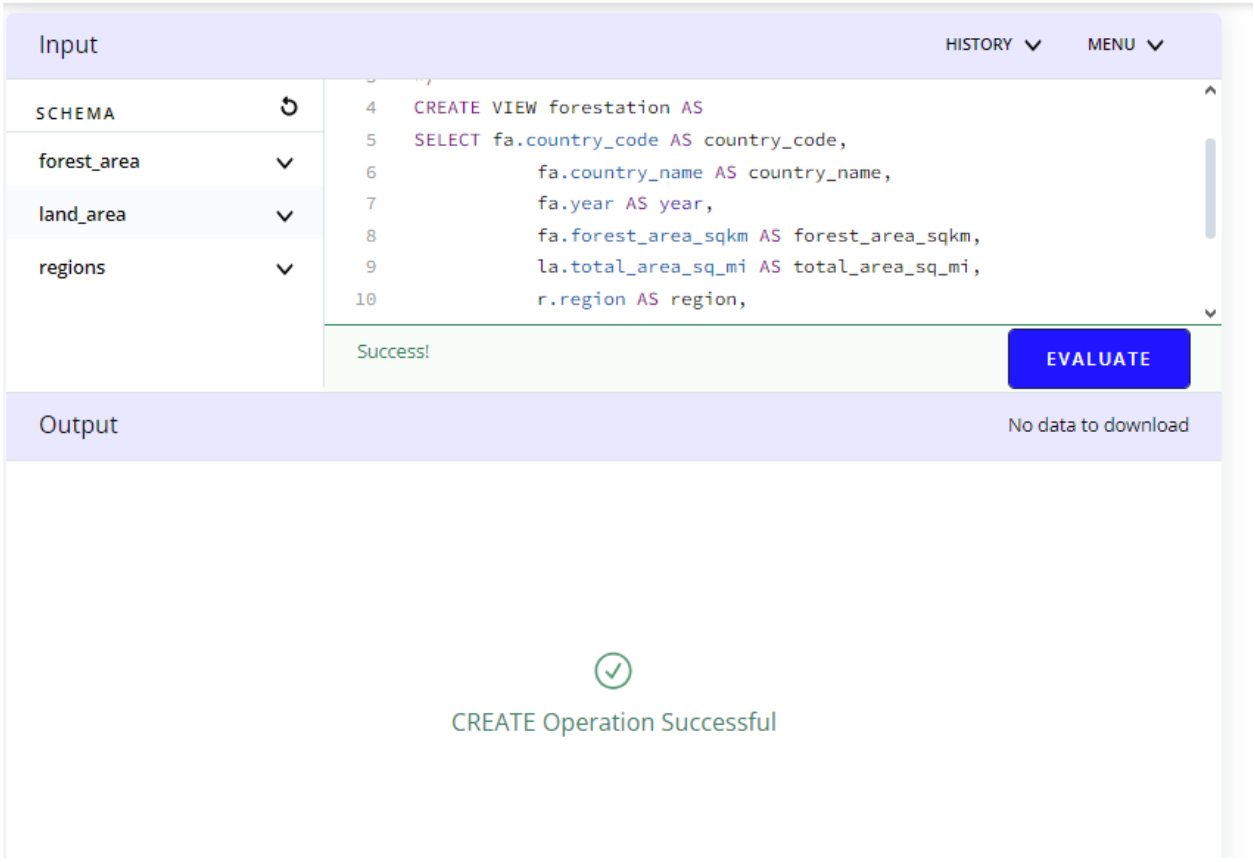
To effectively combat deforestation, it is essential to encourage governments to implement measures that grant property rights for forests to local communities. Introducing tradeable carbon dioxide credits for those who protect these forests could be a valuable strategy to help reverse this negative trend. Additionally, promoting alternative energy sources such as solar power can help diminish reliance on wood, thereby reducing pressure on forest resources.

Moreover, significant agricultural exporters like Brazil may require incentives to prevent further deforestation linked to agricultural expansion. Trade policies, including tariffs, could serve as tools to discourage the establishment of palm oil plantations in undisturbed forest areas.

5. APPENDIX: SQL Queries Used

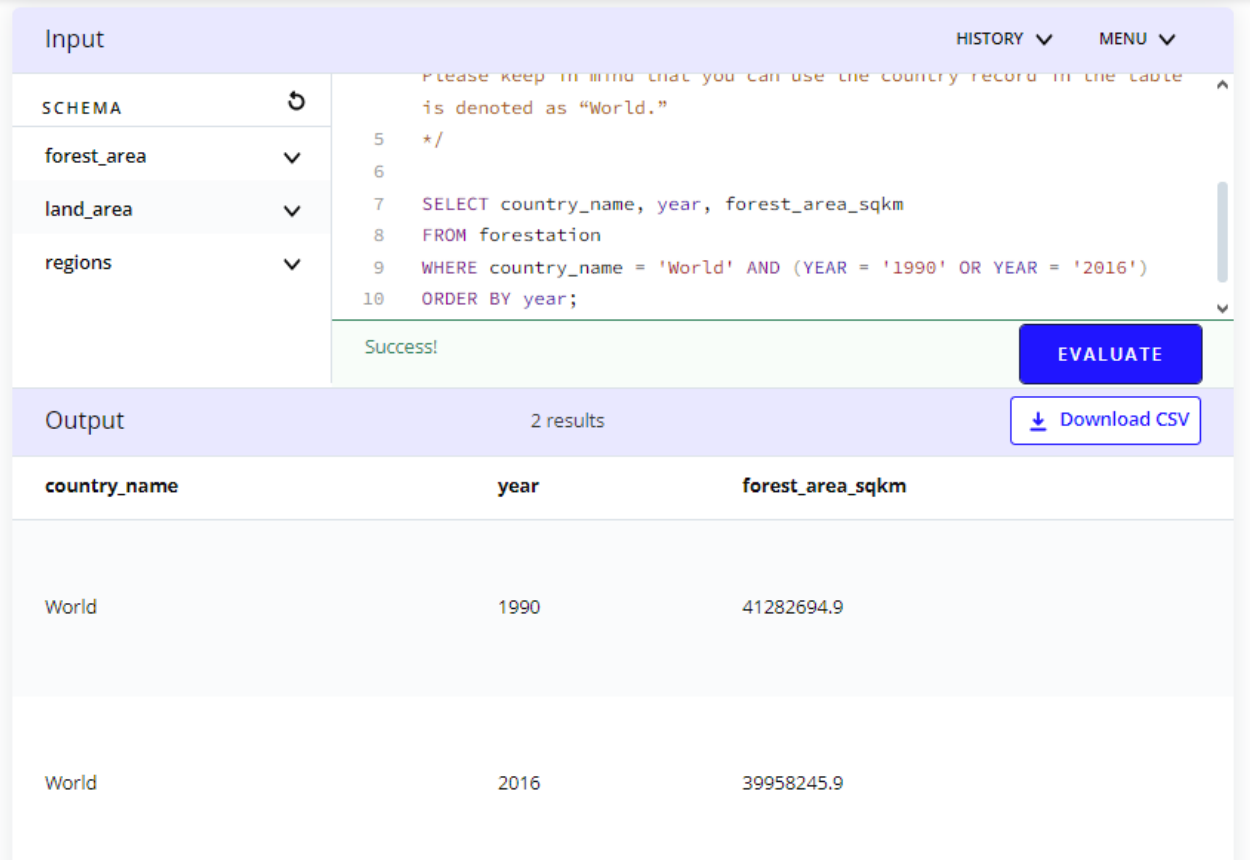
Output Below the queries

```
/*
Create a VIEW called forestation
*/
CREATE VIEW forestation AS
SELECT fa.country_code AS country_code,
        fa.country_name AS country_name,
        fa.year AS year,
        fa.forest_area_sqkm AS forest_area_sqkm,
        la.total_area_sq_mi AS total_area_sq_mi,
        r.region AS region,
        r.income_group AS
income_group,(fa.forest_area_sqkm/(la.total_area_sq_mi*2.59))*100 AS percent_forest
FROM forest_area AS fa, land_area AS la, regions AS r
WHERE fa.country_code = la.country_code AND fa.year = la.year AND la.country_code =
r.country_code;
```

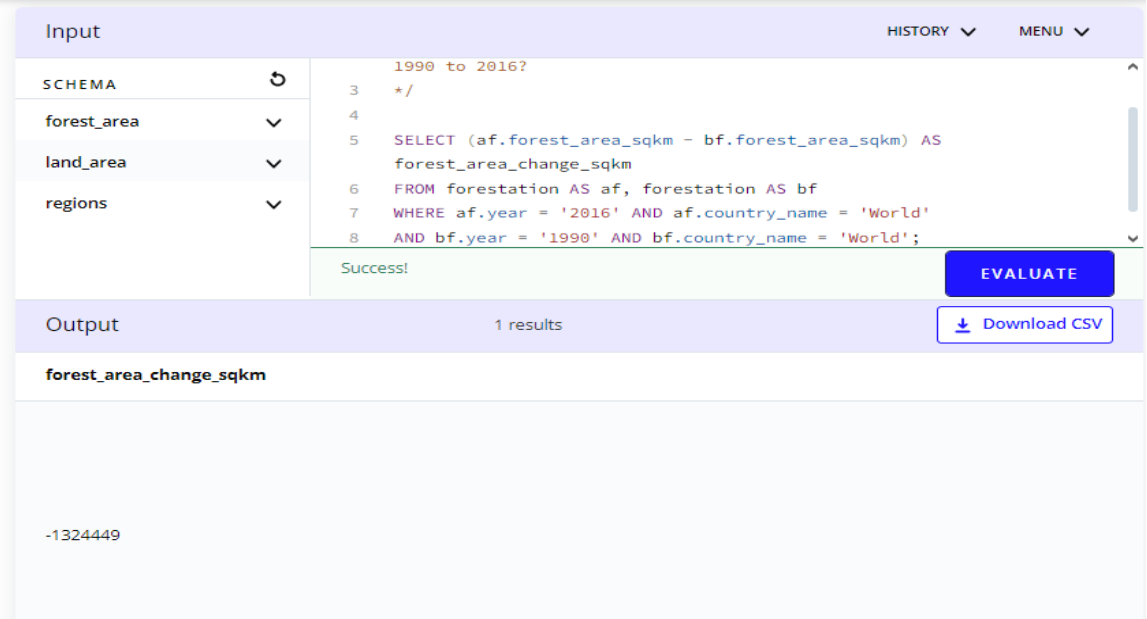


1) PART 1

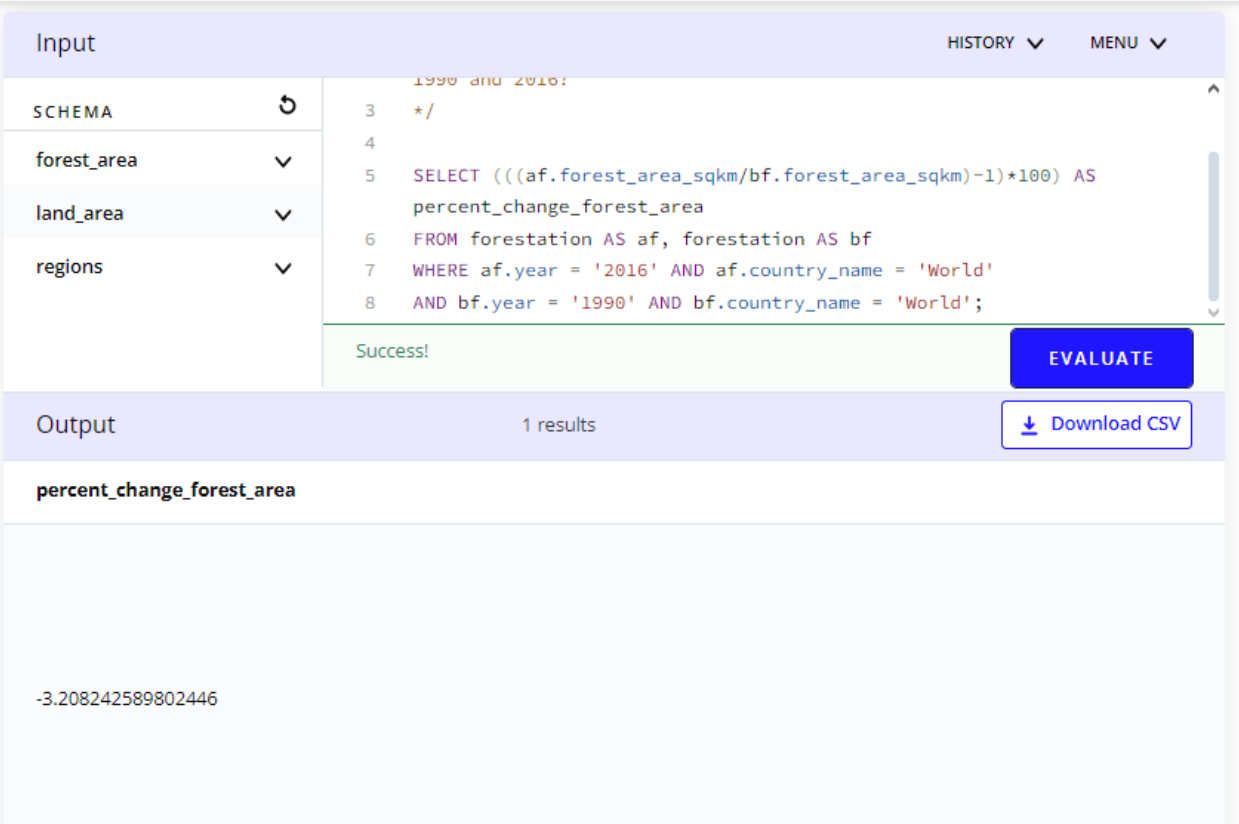
```
/*
a. What was the total forest area (in sq km) of the world in 1990? Please keep in mind that you can use the country record denoted as “World" in the region table.

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 country_name, year, forest_area_sqkm
FROM forestation
WHERE country_name = 'World' AND (YEAR = '1990' OR YEAR = '2016')
ORDER BY year;
```



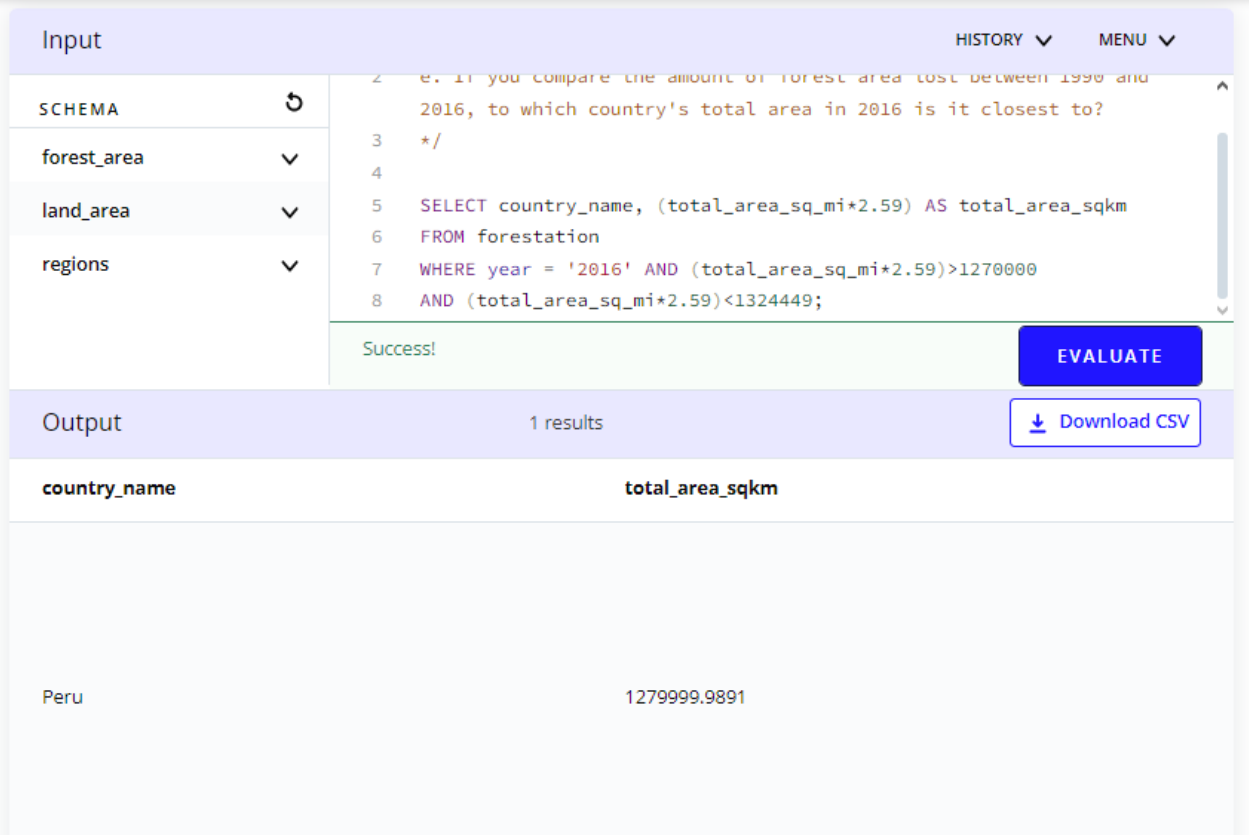
```
/*
c. What was the change (in sq km) in the forest area of the world from 1990 to 2016?
*/

SELECT (af.forest_area_sqkm - bf.forest_area_sqkm) AS forest_area_change_sqkm
FROM forestation AS af, forestation AS bf
WHERE af.year = '2016' AND af.country_name = 'World'
AND bf.year = '1990' AND bf.country_name = 'World';
```



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

SELECT (((af.forest_area_sqkm/bf.forest_area_sqkm)-1)*100) AS
percent_change_forest_area
FROM forestation AS af, forestation AS bf
WHERE af.year = '2016' AND af.country_name = 'World'
AND bf.year = '1990' AND bf.country_name = 'World';
```

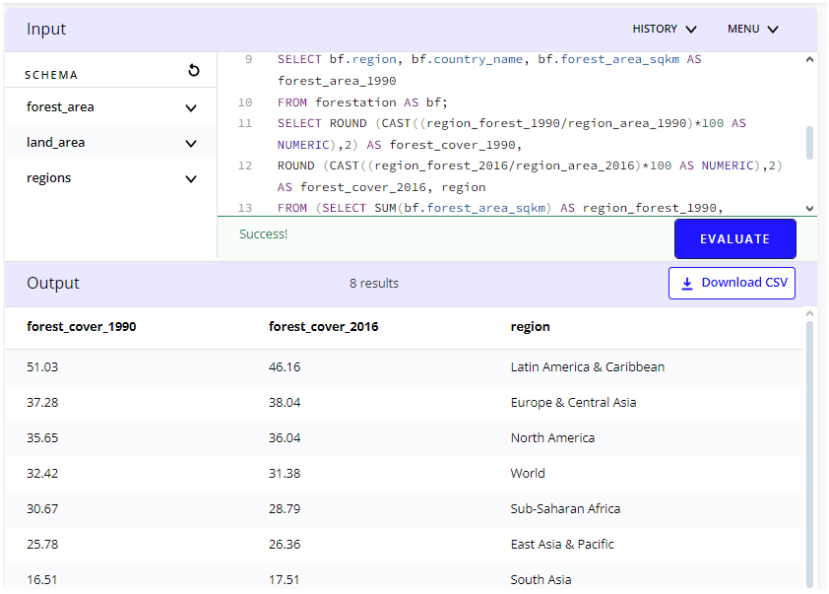


```
/*
e. If you compare the amount of forest area lost between 1990 and 2016, to which country's total area in 2016 is it closest to?
*/

SELECT country_name, (total_area_sq_mi*2.59) AS total_area_sqkm
FROM forestation
WHERE year = '2016' AND (total_area_sq_mi*2.59)>1270000
AND (total_area_sq_mi*2.59)<1324449;
```



2) PART 2

```
/*
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?

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?

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

SELECT bf.region, bf.country_name, bf.forest_area_sqkm AS forest_area_1990
FROM forestation AS bf;
SELECT ROUND (CAST((region_forest_1990/region_area_1990)*100 AS NUMERIC),2) AS
forest_cover_1990,
ROUND (CAST((region_forest_2016/region_area_2016)*100 AS NUMERIC),2) AS
forest_cover_2016, region
FROM (SELECT SUM(bf.forest_area_sqkm) AS region_forest_1990,
      SUM (bf.total_area_sq_mi*2.59) AS region_area_1990, bf.region,
      SUM (af.forest_area_sqkm) AS region_forest_2016,
      SUM (af.total_area_sq_mi*2.59) AS region_area_2016
FROM forestation AS bf, forestation AS af
      WHERE bf.year = '1990'
      AND af.year = '2016'
      AND bf.region = af.region
GROUP BY bf.region) region_percent
ORDER BY forest_cover_1990 DESC;
```



3) PART 3

```
/*
To fill SUCCESS STORIES part 3
*/

SELECT af.country_name, af.region, ROUND (CAST(((af.forest_area_sqkm-
bf.forest_area_sqkm))AS NUMERIC),2) AS forest_area_change_sqkm
FROM forestation AS af
JOIN forestation AS bf
ON (af.year = '2016' AND bf.year = '1990')
AND af.country_code = bf.country_code
WHERE af.country_name != 'World'
AND af.forest_area_sqkm != 0 AND bf.forest_area_sqkm != 0
ORDER BY forest_area_change_sqkm DESC
LIMIT 5;
```

Input HISTORY MENU

SCHEMA

forest_area

land_area

regions

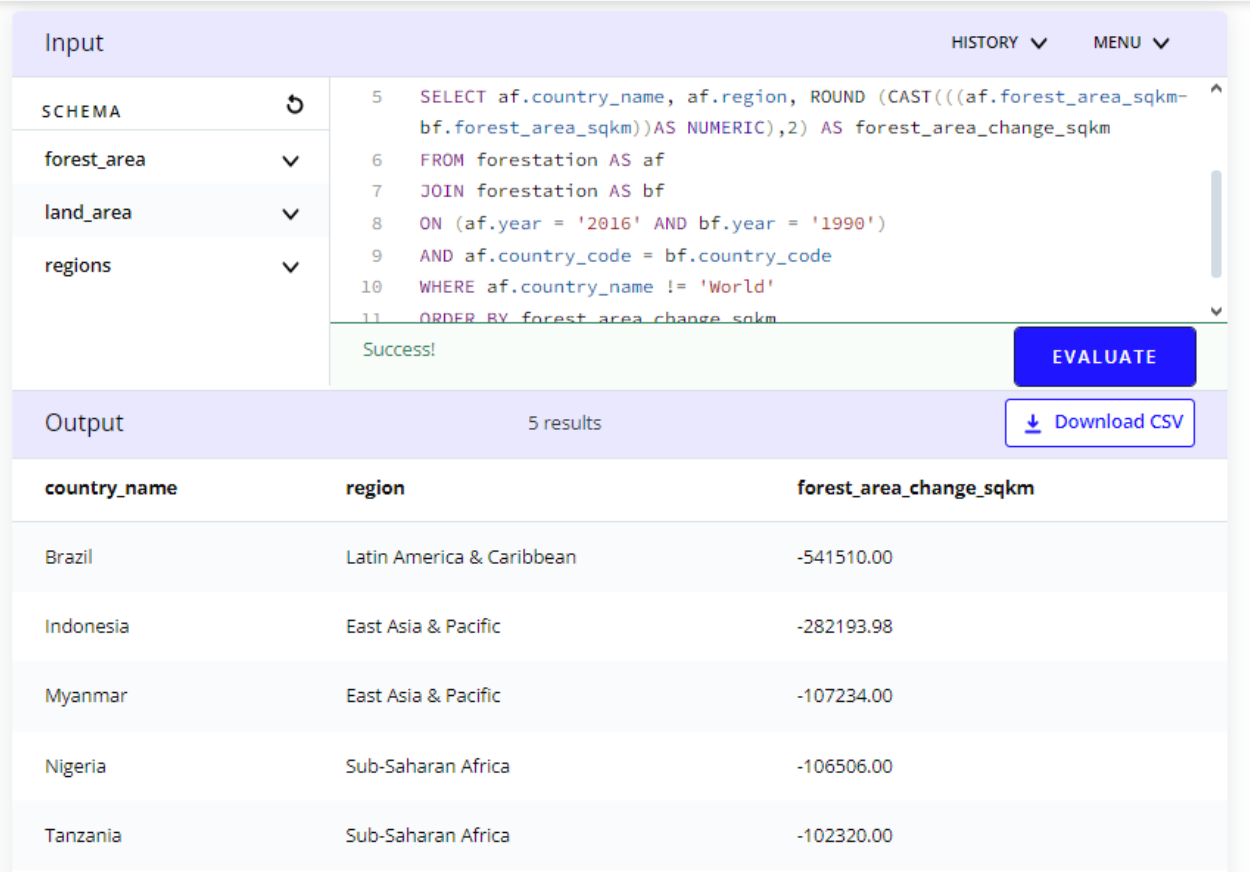
```
5  SELECT af.country_name, af.region, ROUND (CAST(((af.forest_area_sqkm-
   bf.forest_area_sqkm))AS NUMERIC),2) AS forest_area_change_sqkm
6  FROM forestation AS af
7  JOIN forestation AS bf
8  ON (af.year = '2016' AND bf.year = '1990')
9  AND af.country_code = bf.country_code
10 WHERE af.country_name != 'World'
11 AND af.forest_area_sqkm != 0 AND bf.forest_area_sqkm != 0
```

Success! EVALUATE

Output 5 results Download CSV

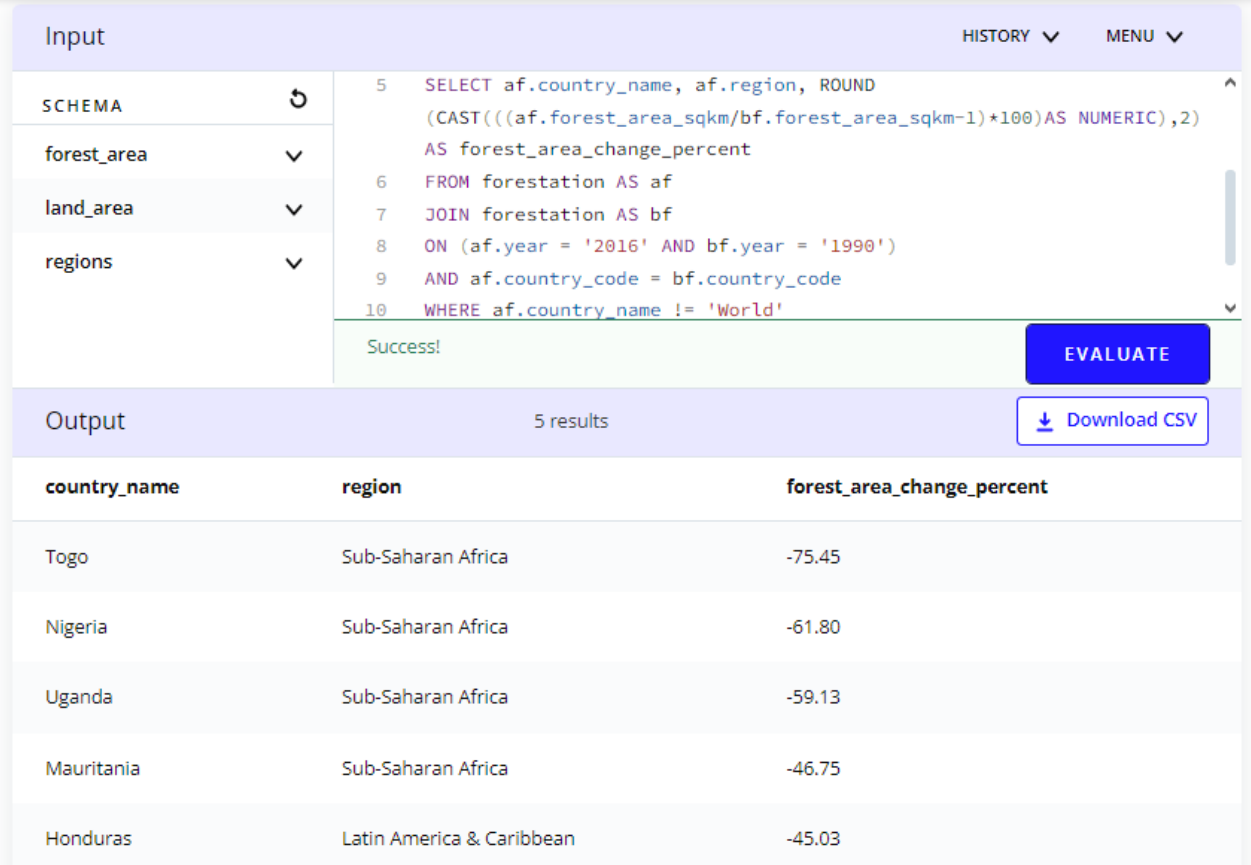
country_name	region	forest_area_change_sqkm
China	East Asia & Pacific	527229.06
United States	North America	79200.00
India	South Asia	69213.98
Russian Federation	Europe & Central Asia	59395.00
Vietnam	East Asia & Pacific	55390.00

```
/*
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?
*/

SELECT af.country_name, af.region, ROUND (CAST(((af.forest_area_sqkm-
bf.forest_area_sqkm))AS NUMERIC),2) AS forest_area_change_sqkm
FROM forestation AS af
JOIN forestation AS bf
ON (af.year = '2016' AND bf.year = '1990')
AND af.country_code = bf.country_code
WHERE af.country_name != 'World'
ORDER BY forest_area_change_sqkm
LIMIT 5;
```



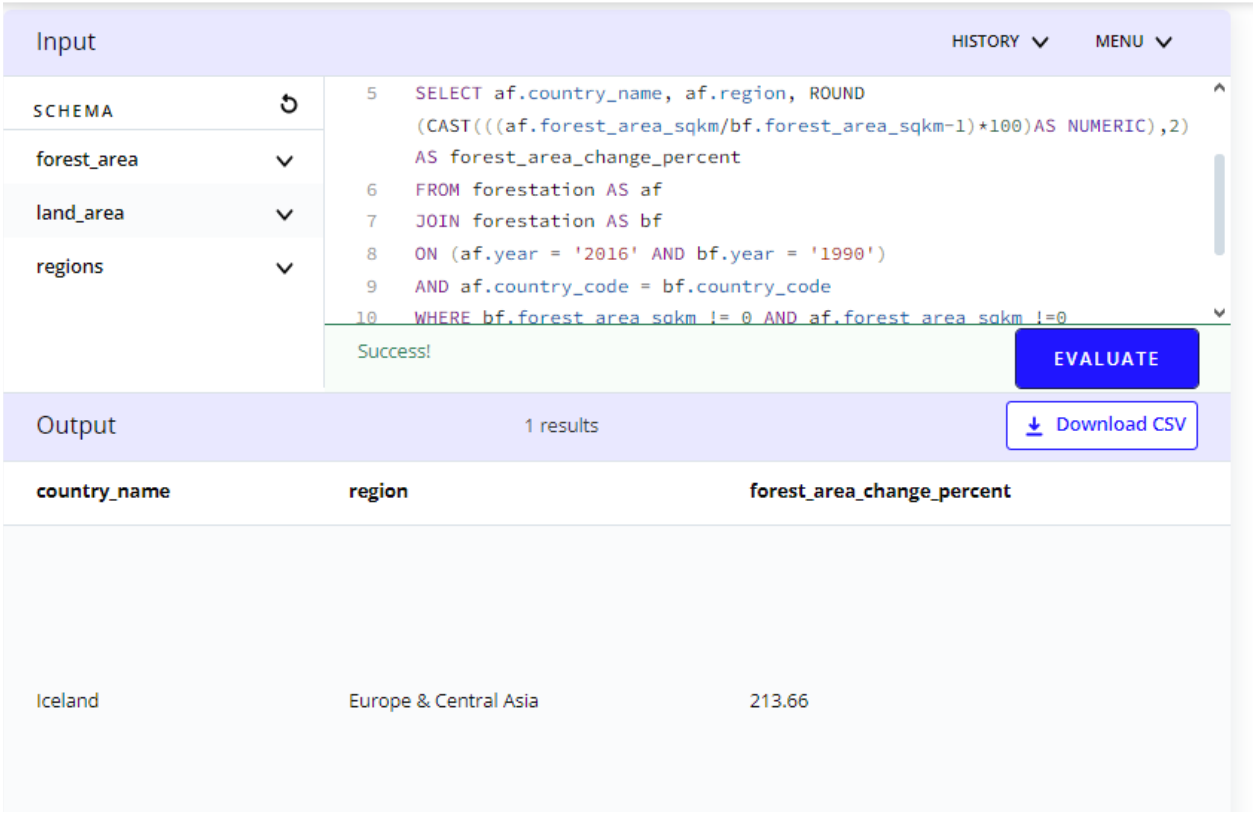
country_name	region	forest_area_change_sqkm
Brazil	Latin America & Caribbean	-541510.00
Indonesia	East Asia & Pacific	-282193.98
Myanmar	East Asia & Pacific	-107234.00
Nigeria	Sub-Saharan Africa	-106506.00
Tanzania	Sub-Saharan Africa	-102320.00

```
/*
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 af.country_name, af.region, ROUND
(CAST(((af.forest_area_sqkm/bf.forest_area_sqkm-1)*100)AS NUMERIC),2) AS
forest_area_change_percent
FROM forestation AS af
JOIN forestation AS bf
ON (af.year = '2016' AND bf.year = '1990')
AND af.country_code = bf.country_code
WHERE af.country_name != 'World'
ORDER BY forest_area_change_percent
LIMIT 5;
```

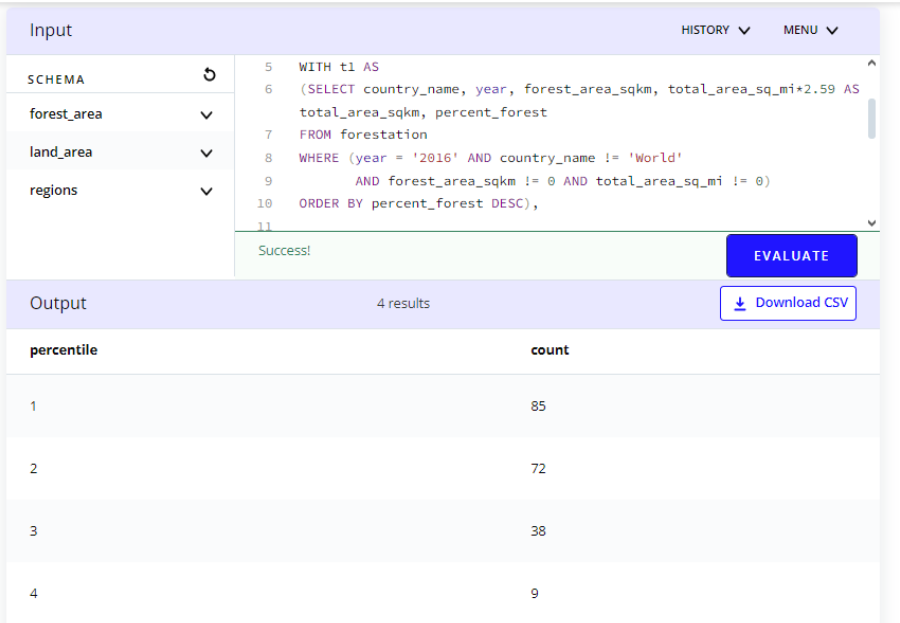


country_name	region	forest_area_change_percent
Togo	Sub-Saharan Africa	-75.45
Nigeria	Sub-Saharan Africa	-61.80
Uganda	Sub-Saharan Africa	-59.13
Mauritania	Sub-Saharan Africa	-46.75
Honduras	Latin America & Caribbean	-45.03

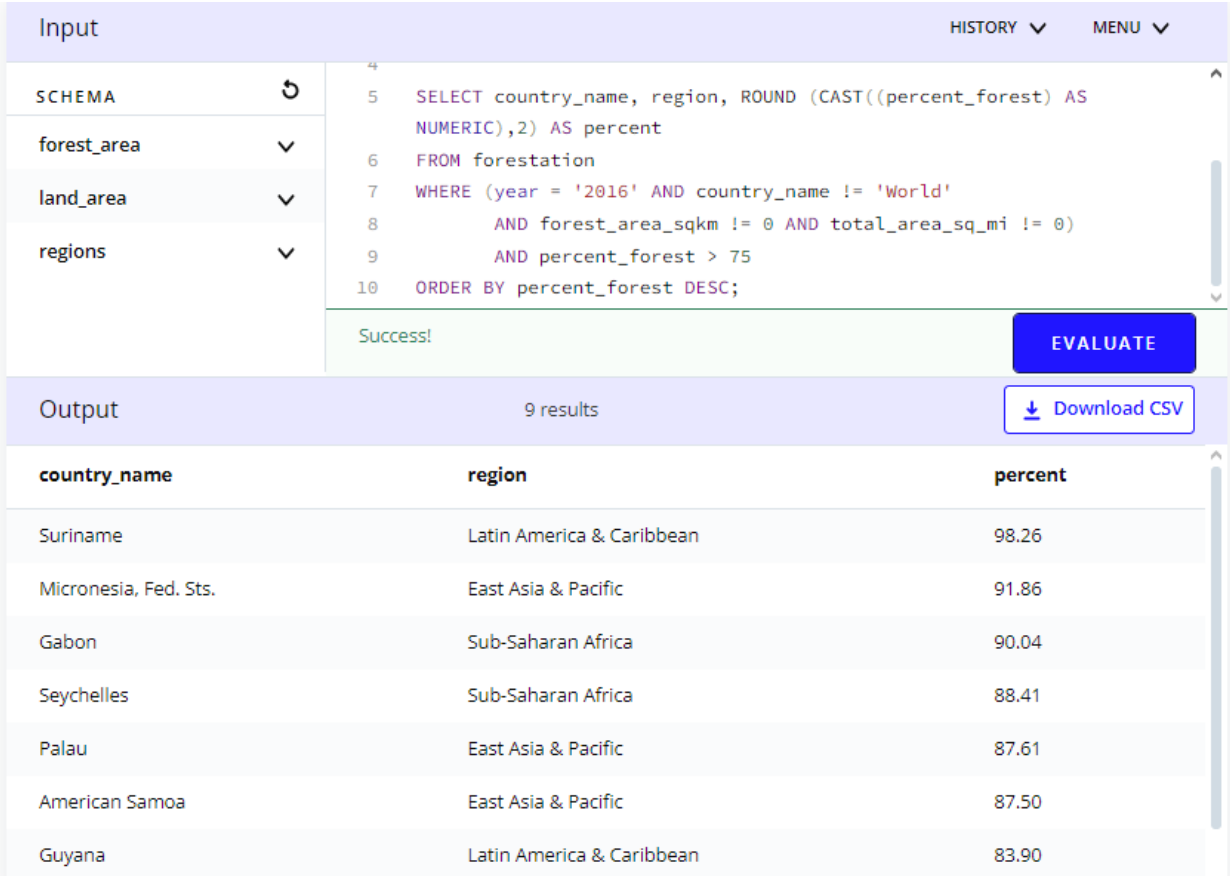
```
/*
largest percent change in forest area from 1990 to 2016
*/

SELECT af.country_name, af.region, ROUND
(CAST(((af.forest_area_sqkm/bf.forest_area_sqkm-1)*100)AS NUMERIC),2) AS
forest_area_change_percent
FROM forestation AS af
JOIN forestation AS bf
ON (af.year = '2016' AND bf.year = '1990')
AND af.country_code = bf.country_code
WHERE bf.forest_area_sqkm != 0 AND af.forest_area_sqkm !=0
ORDER BY forest_area_change_percent DESC
LIMIT 1;
```



```
/*
c. If countries were grouped by percent forestation in quartiles, which group had the most
countries in it in 2016?
*/

WITH t1 AS
(SELECT country_name, year, forest_area_sqkm, total_area_sq_mi*2.59 AS
total_area_sqkm, percent_forest
FROM forestation
WHERE (year = '2016' AND country_name != 'World'
      AND forest_area_sqkm != 0 AND total_area_sq_mi != 0)
ORDER BY percent_forest DESC),

t2 AS
(SELECT t1.country_name, t1.year, t1.percent_forest, CASE WHEN t1.percent_forest > 75
THEN 4
    WHEN t1.percent_forest <= 75 AND t1.percent_forest  > 50 THEN 3
    WHEN t1.percent_forest <= 50 AND t1.percent_forest > 25 THEN 2
    ELSE 1
    END AS percentile
    FROM t1
    ORDER BY 4 DESC)

SELECT t2.percentile, COUNT(t2.percentile)
FROM t2
GROUP BY 1
ORDER BY 2 DESC;
```



```
/*
d. List all of the countries that were in the 4th quartile (percent forest > 75%) in 2016.
*/

SELECT country_name, region, ROUND (CAST((percent_forest) AS NUMERIC),2) AS
percent
FROM forestation
WHERE (year = '2016' AND country_name != 'World'
      AND forest_area_sqkm != 0 AND total_area_sq_mi != 0)
      AND percent_forest > 75
ORDER BY percent_forest DESC;
```



country_name	region	percent
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