19_Benin

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1 How has the relationship between total agricultural land use and arable land share evolved in Benin between 1962 and 2022?

1.1 Abstract

Using World Bank World Development Indicators (WDI), this study examines the evolution of agricultural land use and arable land share in Benin between 1962 and 2022. Over this sixty-year period, both indicators increased steadily, reflecting the country's gradual expansion of land devoted to agriculture. However, arable land — which measures land suitable for crop cultivation — consistently remained about five percentage points below total agricultural land, suggesting that a portion of agricultural land is used for non-arable purposes such as pasture or permanent crops. These parallel yet distinct trajectories reveal a stable long-term relationship, highlighting how Benin's agricultural landscape has expanded without major shifts in land-use composition.

1.2 1. Question

How has the relationship between total agricultural land use and arable land share evolved in Benin between 1962 and 2022?

- **Agricultural land proxy**: Agricultural land (% of land area)
- **Arable land proxy**: Arable land (% of land area)

1.3 2. Data

- **Source**: World Bank World Development Indicators (WDI)
- **Indicators**:
  - Agricultural land (% of land area)
  - Arable land (% of land area)
- **Coverage**: Benin, 1962–2022
- **Notes**: National-level data only

1.4 3. Method

1. Filtered dataset for Benin.
2. **Selected relevant columns**: Year, Indicator Name, Value.
3. Pivoted agricultural and arable land indicators into separate columns and sorted by year.
4. Produced a dual-axis line graph comparing trends in total agricultural land and arable land.

(Analysis is descriptive; no causal inference applied.)

1.5 4. Results

- **Agricultural land (% of land area)**: Increased steadily from 1962 to 2022, indicating a gradual intensification of land use for agricultural purposes.
- **Arable land (% of land area)**: Followed a nearly identical upward trend, though consistently about five percentage points lower, reflecting stable structural differences in land use types.
- **Comparison**: Both indicators rose significantly over time, maintaining a near-constant gap, suggesting balanced growth across both arable and broader agricultural uses.

(Figure 1. Agricultural Land vs Arable Land in Benin, 1962–2022)

(Table 1. Pivoted dataset)

1.6 5. Interpretation

- Benin's long-term increase in both agricultural and arable land shares reflects sustained expansion in agricultural activity, possibly driven by population growth and rural livelihoods.
- The consistent gap between the two measures suggests that land-use diversification — including livestock, permanent crops, or mixed farming systems — has remained structurally stable over decades.
- These patterns highlight a balanced but slow-moving agricultural transformation, where overall land use expands without major shifts in the type or intensity of cultivation.

1.7 6. Limitations

- The analysis does not distinguish between land productivity, crop yield, or soil quality changes over time.
- National-level data may obscure regional variations in land use, degradation, or urban encroachment.
- Descriptive analysis does not assess causal factors such as climate, population pressure, or policy interventions.

1.8 7. Next Steps / Extensions

- Examine regional land-use data to identify areas of expansion, stagnation, or degradation.
- Link land-use trends with agricultural output and rural employment statistics.
- Compare Benin's agricultural land dynamics with other West African countries to identify shared regional patterns.
- Investigate the role of agricultural policy, climate adaptation, and land tenure reforms in shaping long-term land use.

[1]:
```
# How has the relationship between total agricultural land use and arable land␣
↪share evolved in Benin between 1962 and 2022?

import pandas as pd
import matplotlib.pyplot as plt
import os

# Folders
```

```
data_raw_folder = "data_raw/"
data_clean_folder = "data_clean/"
figures_folder = "figures/"

# Load CSV
filename = "climate-change_ben_filtered.csv"  # Filtered dataset with only␣
 ↪relevant rows
df = pd.read_csv(os.path.join(data_raw_folder, filename))

# Keep only needed columns
df = df[["Year", "Indicator Name", "Value"]]

# Convert Year and Value to numeric, drop invalid rows
df["Year"] = pd.to_numeric(df["Year"], errors="coerce")
df["Value"] = pd.to_numeric(df["Value"], errors="coerce")
df = df.dropna(subset=["Year", "Value"])

# Pivot indicators into separate columns
df_pivot = df.pivot(index="Year", columns="Indicator Name", values="Value").
 ↪reset_index()
df_pivot = df_pivot.sort_values("Year")

print("Pivoted Benin dataset:")
display(df_pivot)

# Interpolate missing values for smooth plotting (optional)
df_plot = df_pivot.interpolate(method='linear')

# Plot the two indicators
plt.figure(figsize=(10,6))
plt.plot(df_plot["Year"], df_plot["Agricultural land (% of land area)"],
         marker='o', linestyle='-', label="Agricultural land (% of land area)")
plt.plot(df_plot["Year"], df_plot["Arable land (% of land area)"],
         marker='o', linestyle='-', label="Arable land (% of land area)")

plt.title("Benin: Agricultural land vs Arable land (% of land area)␣
 ↪(1962-2022)")
plt.xlabel("Year")
plt.ylabel("Percentage")
plt.legend()
plt.grid(True)
plt.tight_layout()
plt.savefig(os.path.join(figures_folder,␣
 ↪"benin_agricultural_land_vs_arable_land.png"))
plt.show()

# Save cleaned CSV
```

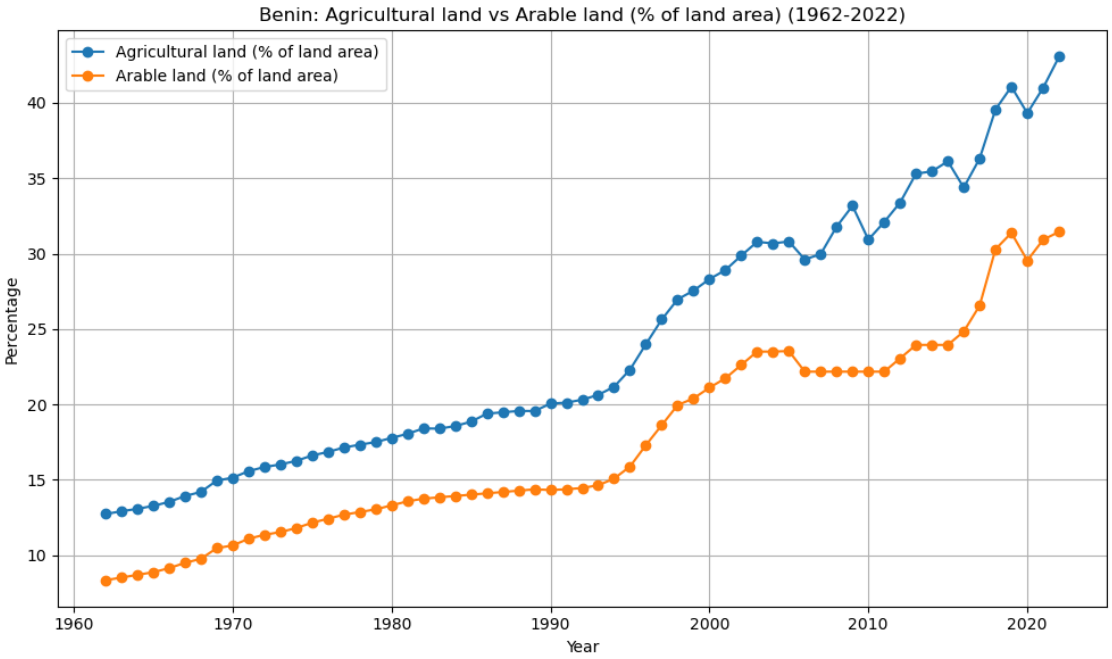
```
df_pivot.to_csv(os.path.join(data_clean_folder,␣
  ↪"benin_agricultural_land_vs_arable_land"), index=False)
```

Pivoted Benin dataset:

```
Indicator Name  Year  Agricultural land (% of land area)  \
0               1962                            12.727474
1               1963                            12.909764
2               1964                            13.069927
3               1965                            13.265032
4               1966                            13.531039
..               …                                  …
56              2018                            39.560204
57              2019                            41.071385
58              2020                            39.314017
59              2021                            41.002346
60              2022                            43.062365

Indicator Name  Arable land (% of land area)
0                                   8.336289
1                                   8.513657
2                                   8.691025
3                                   8.868393
4                                   9.134445
..                                       …
56                                 30.291953
57                                 31.376219
58                                 29.542911
59                                 30.923328
60                                 31.446899

[61 rows x 3 columns]
```


Benin: Agricultural land vs Arable land (% of land area) (1962-2022)
Agricultural land (% of land area)
Arable land (% of land area)
Percentage
Year
10
15
20
25
30
35
40
1960
1970
1980
1990
2000
2010
2020