Global Military Firepower 2025

July 4, 2025

[99]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

[100]:
```
df = pd.read_csv('../data/global_military_firepower_2025.csv')
print(df.head())
print(df.info())
```

```
   rank        country         region  total_population  \
0     1  United States  North America         341963408
1     2         Russia           Asia         140820810
2     3          China           Asia        1415043270
3     4          India           Asia        1409128296
4     5    South Korea           Asia          52081799

   total_military_manpower  fit_for_service  \
0                150463900        124816644
1                 69002197         46189226
2                764123366        626864169
3                662290299        522786598
4                 26040900         21353538

   population_reaching_military_age_annually  active_personnel  \
0                                    4445524           1328000
1                                    1267387           1320000
2                                   19810606           2035000
3                                   23955181           1455550
4                                     416654            600000

   reserve_personnel  paramilitary  ...  natural_gas_production_cum  \
0             799500             0  ...                1.029000e+12
1            2000000        250000  ...                6.178300e+11
2             510000        625000  ...                2.253410e+11
3            1155000       2527000  ...                3.317000e+10
4            3100000        120000  ...                5.512700e+07

   natural_gas_consumption_cum  proven_natural_gas_reserves_cum  \
0                9.143010e+11                     1.340200e+13
```

```
1                4.722390e+11                    4.780500e+13
2                3.661600e+11                    6.654000e+12
3                5.886700e+10                    1.381000e+12
4                5.948000e+10                    7.079000e+09

   coal_production_cum  coal_consumption_mt  proven_coal_reserves_cum  \
0            548849000            476044000              2.489410e+11
1            508190000            310958000              1.621660e+11
2           4827000000           5313000000              1.431970e+11
3            985671000           1200000000              1.110520e+11
4             15595000            136413000              3.260000e+08

   total_land_area_sq_km  coastline_coverage_km  border_coverage_km  \
0                9833517                  19924               12002
1               17098242                  37653               22407
2                9596960                  14500               22457
3                3287263                   7000               13888
4                  99720                   2413                 237

   waterway_coverage_km
0                 41009
1                102000
2                 27700
3                 14500
4                  1600

[5 rows x 57 columns]
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 145 entries, 0 to 144
Data columns (total 57 columns):
 #   Column                                      Non-Null Count  Dtype
---  ------                                      --------------  -----
 0   rank                                        145 non-null    int64
 1   country                                     145 non-null    object
 2   region                                      145 non-null    object
 3   total_population                            145 non-null    int64
 4   total_military_manpower                     145 non-null    int64
 5   fit_for_service                             145 non-null    int64
 6   population_reaching_military_age_annually   145 non-null    int64
 7   active_personnel                            145 non-null    int64
 8   reserve_personnel                           145 non-null    int64
 9   paramilitary                                145 non-null    int64
 10  total_military_aircraft                     145 non-null    int64
 11  fighter_aircraft                            145 non-null    int64
 12  attack_aircraft                             145 non-null    int64
 13  transport_aircraft                          145 non-null    int64
 14  trainer_aircraft                            145 non-null    int64
 15  special_mission_aircraft                    145 non-null    int64
```

```
 16  tanker_aircraft                          145 non-null    int64
 17  total_military_helicopters               145 non-null    int64
 18  attack_helicopters                       145 non-null    int64
 19  tanks                                    145 non-null    int64
 20  armored_fighting_vehicles                145 non-null    int64
 21  self_propelled_artillery                 145 non-null    int64
 22  towed_artillery                          145 non-null    int64
 23  rocket_projectors                        145 non-null    int64
 24  total_naval_fleet                        145 non-null    int64
 25  total_naval_fleet_tonnage_mt             47 non-null     float64
 26  aircraft_carriers                        145 non-null    int64
 27  helicopter_carriers                      145 non-null    int64
 28  submarines                               145 non-null    int64
 29  destroyers                               145 non-null    int64
 30  frigates                                 145 non-null    int64
 31  corvettes                                145 non-null    int64
 32  coastal_patrol_craft                     145 non-null    int64
 33  mine_warfare_craft                       145 non-null    int64
 34  defense_budget_usd                       145 non-null    float64
 35  external_debt_usd                        145 non-null    float64
 36  purchasing_power_parity_usd              145 non-null    float64
 37  foreign_exchange_and_gold_reserves_usd   145 non-null    float64
 38  total_serviceable_airports               145 non-null    int64
 39  labour_force                             145 non-null    int64
 40  major_ports_and_terminals                145 non-null    int64
 41  total_merchant_marine_fleet              145 non-null    int64
 42  railway_coverage_km                      145 non-null    int64
 43  roadway_coverage_km                      145 non-null    int64
 44  oil_production_bbl                       145 non-null    int64
 45  oil_consumption_bbl                      145 non-null    int64
 46  proven_oil_reserves_bbl                  145 non-null    float64
 47  natural_gas_production_cum               145 non-null    float64
 48  natural_gas_consumption_cum              145 non-null    float64
 49  proven_natural_gas_reserves_cum          145 non-null    float64
 50  coal_production_cum                      145 non-null    int64
 51  coal_consumption_mt                      145 non-null    int64
 52  proven_coal_reserves_cum                 145 non-null    float64
 53  total_land_area_sq_km                    145 non-null    int64
 54  coastline_coverage_km                    145 non-null    int64
 55  border_coverage_km                       145 non-null    int64
 56  waterway_coverage_km                     145 non-null    int64
dtypes: float64(10), int64(45), object(2)
memory usage: 64.7+ KB
None
```

[101]:
```
df["total_naval_fleet_tonnage_mt"] = df["total_naval_fleet_tonnage_mt"].fillna(0)
```

[102]:
```
mean_tonnage = df[df["total_naval_fleet_tonnage_mt"].
 ↪notna()]["total_naval_fleet_tonnage_mt"].mean()
df["total_naval_fleet_tonnage_mt"] = df["total_naval_fleet_tonnage_mt"].
 ↪fillna(mean_tonnage)
```

[103]:
```
df_naval = df.dropna(subset=["total_naval_fleet_tonnage_mt"])
```

[104]:
```
# Missing values are checked for each column
print("Missing values:\n", df.isna().sum())
```

```
Missing values:
 rank                                          0
country                                        0
region                                         0
total_population                               0
total_military_manpower                        0
fit_for_service                                0
population_reaching_military_age_annually      0
active_personnel                               0
reserve_personnel                              0
paramilitary                                   0
total_military_aircraft                        0
fighter_aircraft                               0
attack_aircraft                                0
transport_aircraft                             0
trainer_aircraft                               0
special_mission_aircraft                       0
tanker_aircraft                                0
total_military_helicopters                     0
attack_helicopters                             0
tanks                                          0
armored_fighting_vehicles                      0
self_propelled_artillery                       0
towed_artillery                                0
rocket_projectors                              0
total_naval_fleet                              0
total_naval_fleet_tonnage_mt                   0
aircraft_carriers                              0
helicopter_carriers                            0
submarines                                     0
destroyers                                     0
frigates                                       0
corvettes                                      0
coastal_patrol_craft                           0
mine_warfare_craft                             0
defense_budget_usd                             0
external_debt_usd                              0
purchasing_power_parity_usd                    0
```

```
foreign_exchange_and_gold_reserves_usd       0
total_serviceable_airports                   0
labour_force                                 0
major_ports_and_terminals                    0
total_merchant_marine_fleet                  0
railway_coverage_km                          0
roadway_coverage_km                          0
oil_production_bbl                           0
oil_consumption_bbl                          0
proven_oil_reserves_bbl                      0
natural_gas_production_cum                   0
natural_gas_consumption_cum                  0
proven_natural_gas_reserves_cum              0
coal_production_cum                          0
coal_consumption_mt                          0
proven_coal_reserves_cum                     0
total_land_area_sq_km                        0
coastline_coverage_km                        0
border_coverage_km                           0
waterway_coverage_km                         0
dtype: int64
```

[105]:
```
# Top 10 most powerful countries based on global military ranking
top_10 = df.head(10)[["rank", "country"]]
print(top_10)
```

```
   rank         country
0     1   United States
1     2          Russia
2     3           China
3     4           India
4     5     South Korea
5     6  United Kingdom
6     7          France
7     8           Japan
8     9         Turkiye
9    10           Italy
```

[106]:
```
# Total number of active military personnel by region
active_by_region = df.groupby("region")["active_personnel"].sum()
print(active_by_region)
```

```
region
Africa            2735105
Asia             13351900
Europe            2832616
North America     2133489
Oceania             66020
South America     1194100
```

```
Name: active_personnel, dtype: int64
```

[107]:
```
# Average number of tanks by region
avg_tanks_by_region = df.groupby("region")["tanks"].mean()
print(avg_tanks_by_region)
```

```
region
Africa           226.263158
Asia             988.200000
Europe           177.157895
North America    448.818182
Oceania           29.500000
South America    143.000000
Name: tanks, dtype: float64
```

[108]:
```
# Top 10 countries with the highest defense budgets
top_defense_budget = df.nlargest(10, "defense_budget_usd")[["country",␣
↪"defense_budget_usd"]]
print(top_defense_budget)
```

```
           country  defense_budget_usd
0    United States        8.950000e+11
2            China        2.668500e+11
1           Russia        1.260000e+11
3            India        7.500000e+10
23    Saudi Arabia        7.476000e+10
5   United Kingdom        7.150054e+10
7            Japan        5.700000e+10
17       Australia        5.570000e+10
6           France        5.500000e+10
19         Ukraine        5.370000e+10
```

[109]:
```
# Top 10 countries with the highest defense budgets
top_defense_budget = df.nlargest(10, "defense_budget_usd")[["country",␣
↪"defense_budget_usd"]]
print(top_defense_budget)
```

```
           country  defense_budget_usd
0    United States        8.950000e+11
2            China        2.668500e+11
1           Russia        1.260000e+11
3            India        7.500000e+10
23    Saudi Arabia        7.476000e+10
5   United Kingdom        7.150054e+10
7            Japan        5.700000e+10
17       Australia        5.570000e+10
6           France        5.500000e+10
19         Ukraine        5.370000e+10
```

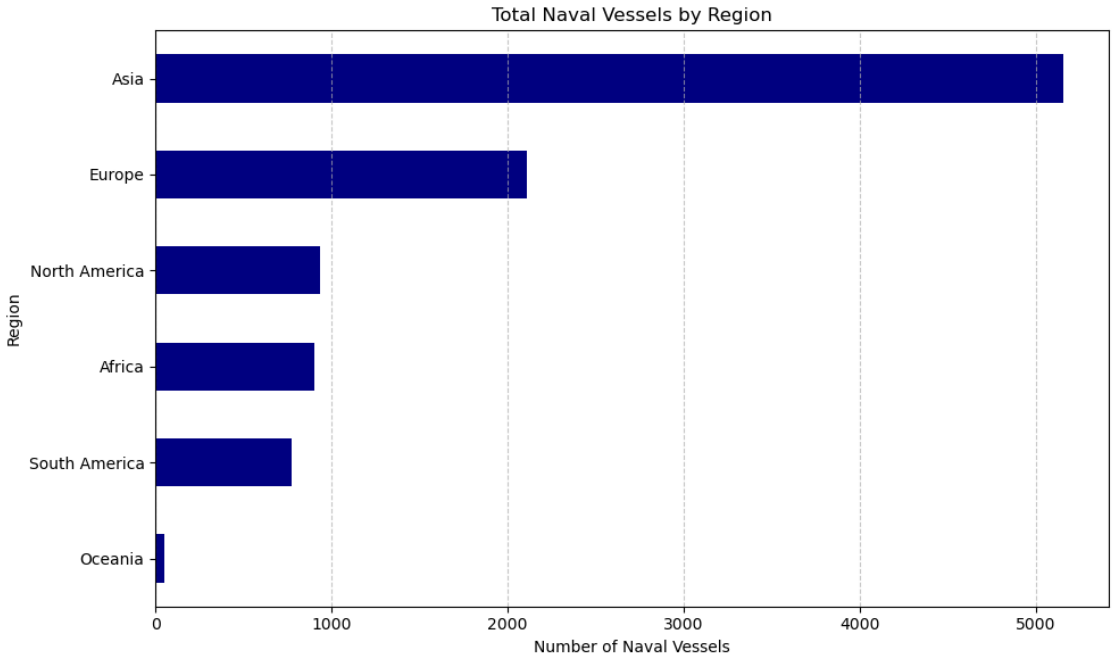
[110]:
```
# Number of fighter aircraft by country (Top 10)
fighter_by_country = df[["country", "fighter_aircraft"]].
 ↪sort_values(by="fighter_aircraft", ascending=False).head(10)
print(fighter_by_country)
```

```
          country  fighter_aircraft
0   United States              1790
2           China              1212
1          Russia               833
3           India               513
33    North Korea               368
11       Pakistan               328
4     South Korea               315
21         Taiwan               285
23   Saudi Arabia               283
14         Israel               240
```

[111]:
```
# Total number of naval vessels by region
naval_by_region = df.groupby("region")["total_naval_fleet"].sum()
print(naval_by_region)
```

```
region
Africa            905
Asia             5156
Europe           2111
North America     931
Oceania            52
South America     776
Name: total_naval_fleet, dtype: int64
```

[112]:
```
plt.figure(figsize=(10, 6))
naval_by_region.sort_values().plot(kind="barh", color="navy")
plt.title("Total Naval Vessels by Region")
plt.xlabel("Number of Naval Vessels")
plt.ylabel("Region")
plt.grid(axis="x", linestyle="--", alpha=0.7)
plt.tight_layout()
plt.show()
```



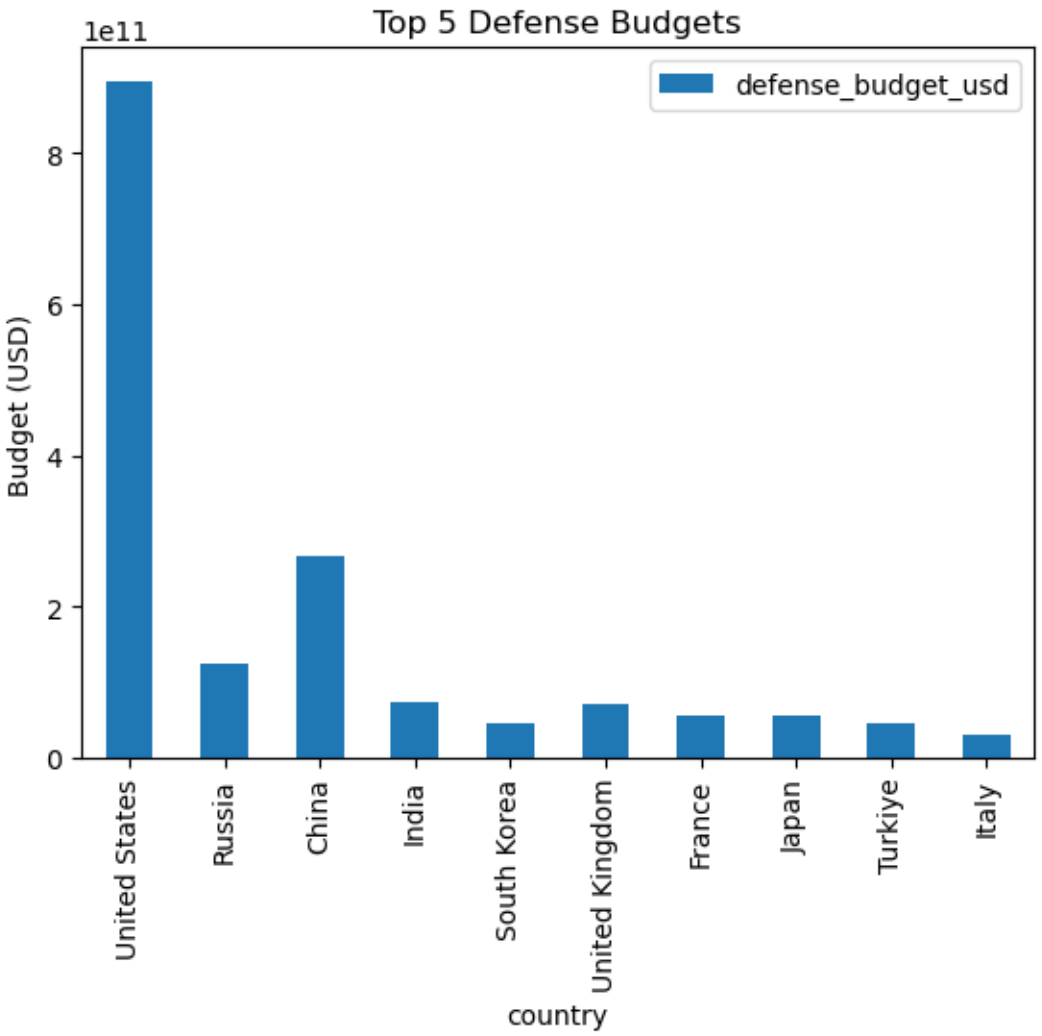
[113]:
```
# Proven oil reserves sorted by rank
oil_reserves_by_rank = df[["rank", "country", "proven_oil_reserves_bbl"]].
 ↪sort_values(by="rank")
print(oil_reserves_by_rank.head(10))
```

	rank	country	proven_oil_reserves_bbl
0	1	United States	3.821200e+10
1	2	Russia	8.000000e+10
2	3	China	2.602300e+10
3	4	India	4.605000e+09
4	5	South Korea	0.000000e+00
5	6	United Kingdom	2.500000e+09
6	7	France	6.171900e+07
7	8	Japan	4.411500e+07
8	9	Turkiye	3.660000e+08
9	10	Italy	4.979340e+08

[114]:
```
# Top 10 countries by number of attack aircraft
top_attack_aircraft = df.nlargest(10, "attack_aircraft")[["country",␣
 ↪"attack_aircraft"]]
print(top_attack_aircraft)
```

```
          country  attack_aircraft
0   United States              889
1          Russia              689
2           China              371
3           India              130
33    North Korea              114
4     South Korea               98
11       Pakistan               90
18          Egypt               90
23   Saudi Arabia               81
9           Italy               67
```

[115]:
```
# top 10 defense budgets by country
import matplotlib.pyplot as plt
df.head(10)[["country", "defense_budget_usd"]].plot(x="country",␣
 ↪y="defense_budget_usd", kind="bar")
plt.title("Top 5 Defense Budgets")
plt.ylabel("Budget (USD)")
plt.show()
```



[116]:
```
# Average number of military helicopters by region
avg_helicopters_by_region = df.groupby("region")["total_military_helicopters"].
 ↪mean()
print(avg_helicopters_by_region)
```

```
region
Africa            43.184211
Asia             204.911111
Europe            79.157895
North America    574.818182
Oceania           45.000000
South America     85.090909
Name: total_military_helicopters, dtype: float64
```

[117]:
```
# Top 10 countries by number of people fit for military service
fit_by_country = df[["country", "fit_for_service"]].
 ↪sort_values(by="fit_for_service", ascending=False).head(10)
print(fit_by_country)
```

```
          country  fit_for_service
2           China        626864169
3           India        522786598
0   United States        124816644
12      Indonesia        114595923
30        Nigeria         90437404
10         Brazil         88680759
11       Pakistan         85803614
34     Bangladesh         66129296
31         Mexico         49811912
1          Russia         46189226
```

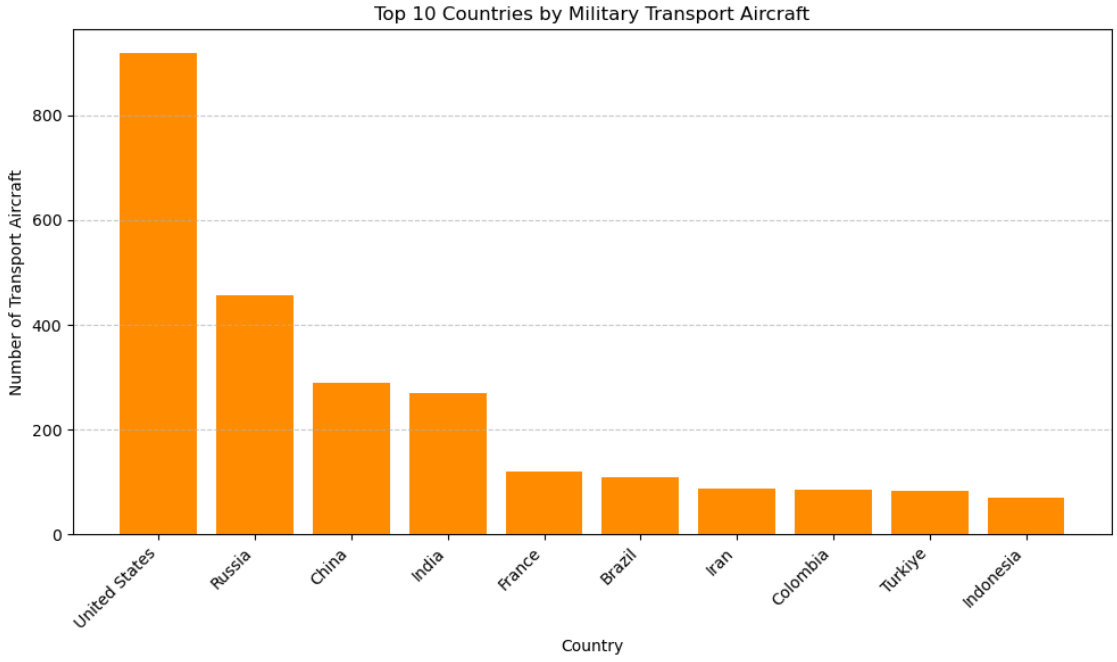
[118]:
```
# Total reserve personnel by region
reserve_by_region = df.groupby("region")["reserve_personnel"].sum()
print(reserve_by_region)
```

```
region
Africa            1186350
Asia             21040300
Europe            4739880
North America     1126005
Oceania             35300
South America     1134500
Name: reserve_personnel, dtype: int64
```

[119]:
```
# Top 10 countries by number of military transport aircraft
top_transport = df.nlargest(10, "transport_aircraft")[["country",␣
 ↪"transport_aircraft"]]
print(top_transport)
```

```
          country  transport_aircraft
0   United States                 918
1          Russia                 456
2           China                 289
3           India                 270
6          France                 119
10         Brazil                 109
15           Iran                  87
45       Colombia                  86
8         Turkiye                  84
12      Indonesia                  70
```

[120]:
```
plt.figure(figsize=(10, 6))
plt.bar(top_transport["country"], top_transport["transport_aircraft"],␣
 ↪color="darkorange")
plt.title("Top 10 Countries by Military Transport Aircraft")
plt.xlabel("Country")
plt.ylabel("Number of Transport Aircraft")
plt.xticks(rotation=45, ha="right")
plt.grid(axis="y", linestyle="--", alpha=0.7)
plt.tight_layout()
plt.show()
```



[121]:
```
# Natural resources vs military rank (Top 10)
resource_impact = df[["rank", "proven_oil_reserves_bbl",␣
 ↪"proven_coal_reserves_cum"]].head(10)
print(resource_impact)
```

```
   rank  proven_oil_reserves_bbl  proven_coal_reserves_cum
0     1             3.821200e+10              2.489410e+11
1     2             8.000000e+10              1.621660e+11
2     3             2.602300e+10              1.431970e+11
3     4             4.605000e+09              1.110520e+11
4     5             0.000000e+00              3.260000e+08
5     6             2.500000e+09              2.600000e+07
6     7             6.171900e+07              1.600000e+08
7     8             4.411500e+07              3.500000e+08
8     9             3.660000e+08              1.152500e+10
```

```
9    10              4.979340e+08              6.099990e+08
```

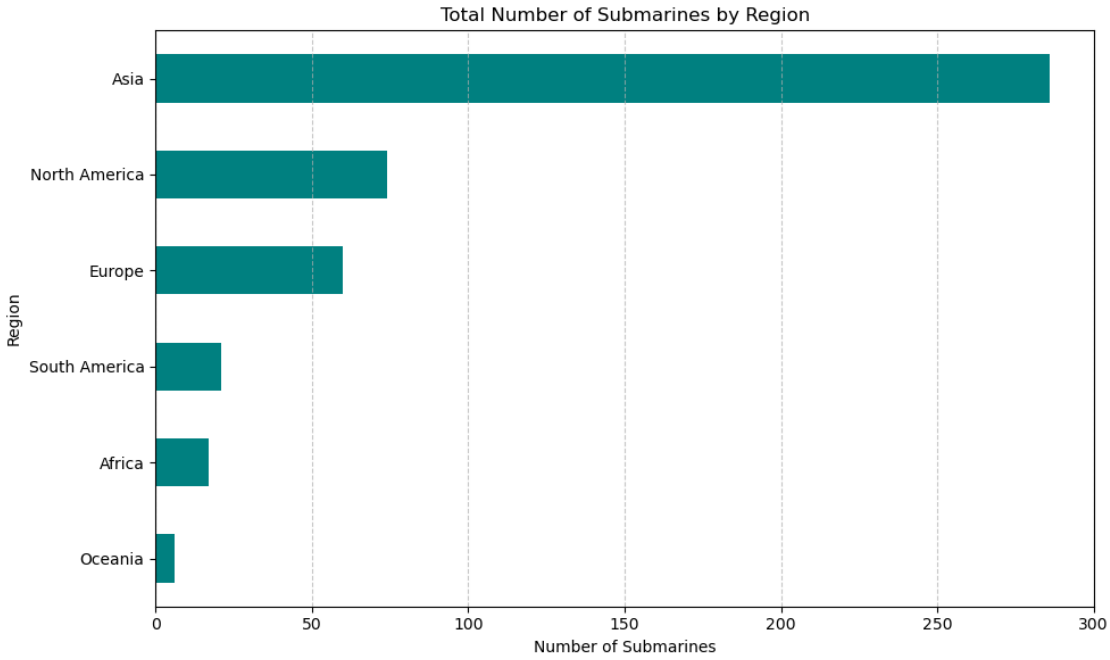
[122]:
```
# Top 10 countries by total land area (sq km)
top_land_area = df.nlargest(10, "total_land_area_sq_km")[["country",␣
 ↪"total_land_area_sq_km"]]
print(top_land_area)
```

```
          country  total_land_area_sq_km
1          Russia               17098242
27         Canada                9984670
0   United States                9833517
2           China                9596960
10         Brazil                8515770
17      Australia                7741220
3           India                3287263
32      Argentina                2780400
56     Kazakhstan                2724900
25        Algeria                2381740
```

[123]:
```
# Number of submarines by region
subs_by_region = df.groupby("region")["submarines"].sum()
print(subs_by_region)
```

```
region
Africa            17
Asia             286
Europe            60
North America     74
Oceania            6
South America     21
Name: submarines, dtype: int64
```

[124]:
```
plt.figure(figsize=(10, 6))
subs_by_region.sort_values().plot(kind="barh", color="teal")
plt.title("Total Number of Submarines by Region")
plt.xlabel("Number of Submarines")
plt.ylabel("Region")
plt.grid(axis="x", linestyle="--", alpha=0.7)
plt.tight_layout()
plt.show()
```



[125]:
```
# Average naval tonnage (weight capacity) by country (Top 10)
avg_naval_tonnage = df.groupby("country")["total_naval_fleet_tonnage_mt"].mean().
↪sort_values(ascending=False).head(10)
print(avg_naval_tonnage)
```

```
country
United States     4168037.0
China             2857143.0
Russia            1260447.0
Japan              769882.0
India              593603.0
France             428765.0
United Kingdom     394043.0
Italy              359417.0
South Korea        344786.0
Turkiye            325729.0
Name: total_naval_fleet_tonnage_mt, dtype: float64
```

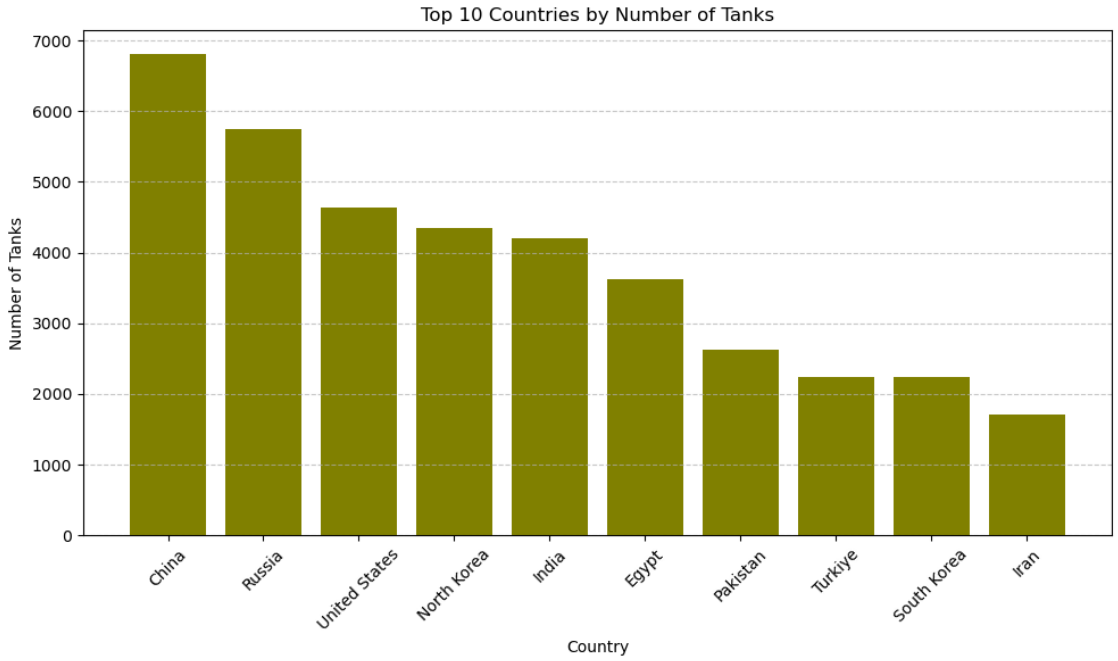
[126]:
```
# Top 10 countries with most major seaports
ports_by_country = df[["country", "major_ports_and_terminals"]].
 ↪sort_values(by="major_ports_and_terminals", ascending=False).head(10)
print(ports_by_country)
```

```
           country  major_ports_and_terminals
0    United States                        666
27          Canada                        284
5    United Kingdom                        185
7             Japan                        163
37           Norway                        141
12        Indonesia                        123
9             Italy                        123
26           Sweden                         92
40      Philippines                         70
44          Denmark                         69
```

[127]:
```
# Top 10 countries with most tanks
top_tanks = df.nlargest(10, "tanks")[["country", "tanks"]]
print(top_tanks)
```

```
           country  tanks
2            China   6800
1           Russia   5750
0    United States   4640
33     North Korea   4344
3            India   4201
18           Egypt   3620
11        Pakistan   2627
8          Turkiye   2238
4      South Korea   2236
15            Iran   1713
```

[128]:
```
plt.figure(figsize=(10, 6))
plt.bar(top_tanks["country"], top_tanks["tanks"], color="olive")
plt.title("Top 10 Countries by Number of Tanks")
plt.xlabel("Country")
plt.ylabel("Number of Tanks")
plt.xticks(rotation=45)
plt.grid(axis="y", linestyle="--", alpha=0.7)
plt.tight_layout()
plt.show()
```



[129]:
```
# Total defense budget by region
budget_by_region = df.groupby("region")["defense_budget_usd"].sum()
print(budget_by_region)
```

```
region
Africa           7.006121e+10
Asia             8.851772e+11
Europe           4.900391e+11
North America    9.511152e+11
Oceania          5.873000e+10
South America    7.161092e+10
Name: defense_budget_usd, dtype: float64
```

[130]:
```
# Top 10 countries with the most armored fighting vehicles
top_afv = df.nlargest(10, "armored_fighting_vehicles")[["country",␣
 ↪"armored_fighting_vehicles"]]
print(top_afv)
```

```
          country  armored_fighting_vehicles
0   United States                     391963
3           India                     148594
2           China                     144017
1          Russia                     131527
6          France                     110932
13        Germany                      83260
9           Italy                      73480
```

```
15           Iran                    65825
29         Greece                    61888
8         Turkiye                    61173
```

[131]:
```
# Countries with shared borders longer than 10,000 km
high_border = df[df["border_coverage_km"] > 10000][["country",␣
↪"border_coverage_km"]]
print(high_border)
```

```
                          country  border_coverage_km
0                   United States               12002
1                          Russia               22407
2                           China               22457
3                           India               13888
10                         Brazil               16145
32                      Argentina               11968
56                     Kazakhstan               13364
65  Democratic Republic of the Congo               10481
```

[132]:
```
# Effect of number of attack helicopters on global ranking
heli_impact = df[["rank", "attack_helicopters"]].sort_values(by="rank").head(10)
print(heli_impact)
```

```
   rank  attack_helicopters
0     1                1002
1     2                 557
2     3                 281
3     4                  80
4     5                 111
5     6                  37
6     7                  68
7     8                 119
8     9                 111
9    10                  37
```

[133]:
```
# Top 10 countries in coal production
top_coal = df.nlargest(10, "coal_production_cum")[["country",␣
↪"coal_production_cum"]]
print(top_coal)
```

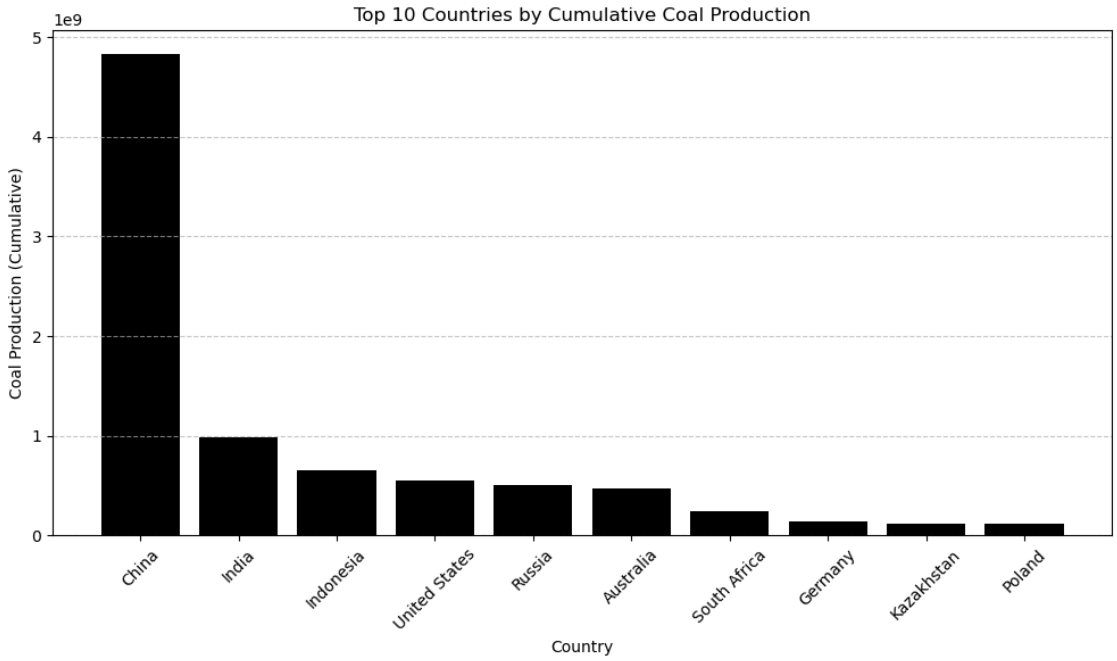
```
          country  coal_production_cum
2           China           4827000000
3           India            985671000
12      Indonesia            659357000
0   United States            548849000
1          Russia            508190000
17      Australia            465865000
39   South Africa            245467000
13        Germany            138981000
```

```
56     Kazakhstan            118195000
20         Poland            116682000
```

[134]:
```
top_coal = df.nlargest(10, "coal_production_cum")[["country",␣
 ↪"coal_production_cum"]]
print("Top 10 Countries in Coal Production (Cumulative):")
print(top_coal)

plt.figure(figsize=(10, 6))
plt.bar(top_coal["country"], top_coal["coal_production_cum"], color="Black")
plt.title("Top 10 Countries by Cumulative Coal Production")
plt.xlabel("Country")
plt.ylabel("Coal Production (Cumulative)")
plt.xticks(rotation=45)
plt.tight_layout()
plt.grid(axis="y", linestyle="--", alpha=0.7)
plt.show()
```

```
Top 10 Countries in Coal Production (Cumulative):
          country  coal_production_cum
2           China           4827000000
3           India            985671000
12      Indonesia            659357000
0   United States            548849000
1          Russia            508190000
17      Australia            465865000
39   South Africa            245467000
13        Germany            138981000
56     Kazakhstan            118195000
20         Poland            116682000
```


Top 10 Countries by Cumulative Coal Production
1e9
5
4
3
2
1
0
Coal Production (Cumulative)
China
India
Indonesia
United States
Russia
Australia
South Africa
Germany
Kazakhstan
Poland
Country