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Geopolitics of Arctic Oil and Gas: The Dwindling Relevance of Territorial Claims

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Abstract

Since the Arctic is abundant in natural resources, legal jurisdiction over Arctic territory has become a contentious issue. This paper examines how undiscovered Arctic oil and gas resources are distributed within the territories of the eight Arctic nations and within the territories claimed by these nations. Knowing how resources are distributed will help determine whether it is worth having disputes over the claimed territories as well as determining the importance of the U.S. ratifying the United Nations Convention on the Law of the Sea (UNCLOS).[1]

This paper utilized geo-processing and areal estimation from United States Geological Survey (USGS); Arctic resource data; and territorial border data for probing the above issues. The analysis suggests that most of the resources are distributed within existing rather than claimed territories. The key conclusions are: (1) extended continental shelf claims should not be a major point of contention; (2) the U.S. and Russia are overwhelmingly the largest holders of undiscovered Arctic oil and gas; (3) the U.S. has little reason to ratify the UNCLOS for the purpose of securing energy resources; and (4) Greenland may be unexpectedly important in future Arctic discussions. These findings alter the geopolitics of undiscovered Arctic resources and shift the importance onto energy resources within existing territories.

Keywords: Arctic, energy, resources, territorial claims, ECS

Acronyms

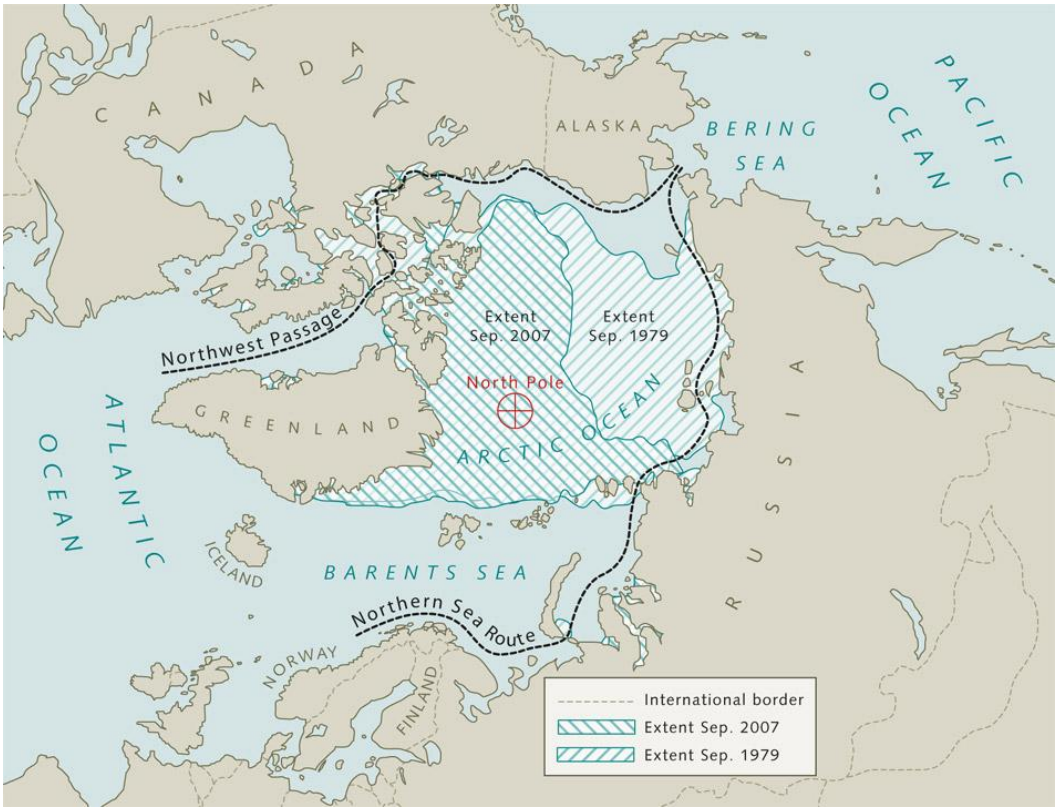
UNCLOS	United Nations Convention on the Law of the Sea
EEZ	Exclusive Economic Zone
ECS	Extended Continental Shelf
USGS	United States Geological Survey
GIS	Geographic information system

Area of Study

Figure 1: Map of the Arctic Region (enclosed by red line)

Source: *Map of the Arctic*. Public domain: 2009. From Wikimedia Commons. http://en.wikipedia.org/wiki/File:Arctic_circle.svg.

Figure 2: Map of Trans-Arctic Waterways



Source: *Map of Northwest Passage and Northern Sea Route*. From World Ocean Review. http://worldoceanreview.com/en/files/2010/10/k10_wk_arktis_eisrueckgang_e_en.jpg

1. Introduction

Control over Arctic territory is an important emerging issue. There are three primary reasons for geopolitical interest in the Arctic: first, the Trans-Arctic waterways (i.e. the Northern Sea Route and Northwest Passage) are expected to significantly shorten global shipping routes; second, there is an abundance of natural resources in the Arctic; third, there are disputes over international governance and border issues, which also impacts control over the aforementioned waterways and resources.[2]

There are currently five unresolved Arctic territorial disputes, with the most prominent being Russia's extended continental shelf (ECS) claim to the Lomonosov Ridge. If accepted, the

claim would grant Russia jurisdiction over approximately half of the Arctic as well as ownership of the natural resources within.[3] In an era of increasing global demand for scarce resources, control of energy resources is of vital geopolitical importance.

The states most influenced by these Arctic disputes are the eight Arctic nations: Canada, the Kingdom of Denmark (which includes Greenland and the Faroe Islands), Finland, Iceland, Norway, Russia, Sweden, and the United States. Of those, only the five Arctic littoral states can make ECS claims in the Arctic: Canada, the Kingdom of Denmark, Iceland, Russia, and the United States.

In order to better understand what is at stake, this paper examines the distribution of energy resources within the territories of the eight Arctic states. It also examines the resource distribution within existing territories, claimed ECS territories, and within unclaimed international territory. Literature on issues related to control over Arctic resources is sparse. Therefore the primary purpose of this study is to enhance understanding of who owns what resources and to determine how much ECS claims matter. The results of this analysis can also be used to help U.S. policymakers determine how much effort should be spent disputing ECS claims as well as whether to ratify the UNCLOS for the purpose of claiming energy resources.

2. Background

An important concept in Arctic territorial disputes is the distinction between exclusive economic zones (EEZ) and extended continental shelf claims. Articles 55 and 56 of the UNCLOS defines an exclusive economic zone to be an area “beyond and adjacent” to a state’s territorial waters and provides the state with “sovereign rights... [over] managing the natural

resources" within the zone. Article 57 proclaims that a state's EEZ "shall not extend beyond 200 nautical miles" from its coast. To extend past the 200 nautical mile limit, nations can make claims on their extended continental shelf (ECS), giving them exclusive jurisdiction over resources within the claimed ECS region.[4]

EEZs are well established and this paper considers them to be part of a state's *existing territory. Claimed territory* refers to ECS claims, and these are the primary subjects of territorial disputes. Note that regions of ECS claims are out in the open sea, and extraction of their energy resources would require offshore drilling platforms.

In 2008, the U.S. Geological Survey (USGS) released an appraisal estimating the amount of undiscovered Arctic oil and natural gas within the Arctic Circle. Notably, this appraisal pertained to technically recoverable oil, but excluded economic considerations such as extraction costs and market selling price. The appraisal used a probabilistic model to estimate the amount of oil and gas deposits within geological provinces in the Arctic (e.g. sedimentary basins).[5]

While the appraisal report did not look at how the resources were distributed across sovereign territories, a rough comparison of the major geological provinces with a world map suggested the existing territories of the U.S. and Russia potentially contained significant portions of undiscovered Arctic oil and gas. That rough comparison provides the precursor to this paper's analysis.

3. Data and Methodology

The paper used four sets of data: (1) USGS Arctic resources appraisal; (2) world map; (3) extended economic zone (EEZ) data; and (4) extended continental shelf (ECS) claim

submissions. Appendix A contains details on the data sources. Appendix C provides a map visualization that overlays the four data layers together.

3.1. Overview

The analysis used geo-processing and areal estimations to determine oil and gas resources within the territory of the eight Arctic nations. The results are largely hypothetical and should be treated as rough estimates. Since *undiscovered* resources can only be estimated at this point, the 2008 USGS appraisal was based on a probabilistic model.[6] The USGS data also did not estimate the distribution of resources within individual geologic provinces. However, to conduct the analysis, the distribution was assumed to be uniform.

3.2. Methodology

The USGS resource layer was intersected with two territory layers. The first layer comprised existing territories, created by merging the world map and EEZ layers. The second layer was of potential total territory and was created by merging the world map, EEZ, and ECS layers.

The resources in the ECS claims were calculated in a spreadsheet to reflect the difference in resources between the two intersection layers. A more direct alternative would have been to perform an intersect using only the ECS layer, but due to resolution differences, potential overlaps would have been double counted.[7] Therefore, the method chosen instead involved taking the difference from two intersection layers. This method relied on merges, which eliminated the problem of double counting overlaps.

To determine the resources in unclaimed international territory, a union was performed between the USGS resource layer and the *potential total territory layer* (merge of world map,

EEZ, and ECS layers). The polygons without any country identification attribute represented unclaimed international territory. Work flow charts of the data preparation and GIS analysis are provided in Appendix B.

3.3. Limitations

Two potential sources of error in this analysis are the assumption of uniform resource distribution and the method of areal estimation. Assuming resources are uniformly distributed within geologic provinces is an oversimplification of geological formations. However, oil and gas reservoirs tend to extend long distances, potentially mitigating problems with this assumption.[8]

The other issue is the method of areal estimation for polygons. This analysis utilized ESRI ArcGIS's internal area estimation function that is automatically calculated and maintained for feature classes within geodatabases. However, this method of areal estimation is a black box: ArcGIS's algorithm, its limitations, and its margin of error are unknown.

To overcome this problem a method similar to ground truthing[9] was performed to test the accuracy of ArcGIS's areal estimation algorithm. Countries' ArcGIS area estimation was compared to their official known areas. The discrepancies were around 2% or less and were considered acceptable for the purposes of this analysis. Note that the analysis results are presented in units of percent (i.e. percent of total resources). This means the 2% discrepancy is a percentage of a percentage (e.g. 1% ± 0.02%, 3% ± 0.06%).[10]

Additionally, to minimize errors in areal estimation, all the feature classes were re-projected into North Pole Lambert Azimuthal Equal Area.[11] The USGS resource feature class was originally in an azimuthal projection, so distortions from this re-projection should be

minimal for the Arctic.[12] The remaining feature classes were originally in an unprojected geographic coordinate system (GCS) and, therefore, not sources of distortions.[13]

4. Analysis:

The overwhelming majority of undiscovered Arctic oil and gas resources were found to be within existing territories of the U.S. and Russia. Also, ECS claims do not appear to matter very much. While the amounts within ECS claims are not trivial (Table 4), they are not significant either. If economic viability were to be considered, the amounts within the ECS claims could potentially become inconsequential, as the economically viable quantities are likely to be a fraction of the amounts listed in Table 4. Additionally, the potential claimable region for the U.S. (the Amerasia basin) might be divided between the U.S. and Canada, as both their EEZs border it.

4.1. Key Findings

1. ECS claims do not contain significant amounts of Arctic oil and gas resources.
    a. Russian ECS claims account for less than 3% of total undiscovered Arctic oil and gas (Table 4).
    b. Potential U.S. ECS claims would provide less than 4% of total undiscovered Arctic oil (Table 2).
2. Arctic oil and gas are overwhelmingly within *existing* territories (Table 3).
    a. The U.S. and Russia each own about 30% of total undiscovered Arctic oil, for a total of 60%.
    b. Russia owns about 66% of total undiscovered Arctic gas.

3. Greenland/Denmark is the third largest holder of Arctic oil and gas (Table 3).

4.2. Detailed Results

The results of the analysis are provided in Table 1 and Table 2. Table 3 and Table 4 re-sort Table 1 by largest holding of resources. Figure 3 and Figure 4 map the distribution of resources by territory.

Note that the U.S. cannot submit any ECS claims as it is not a member to the UNCLOS. However, if it wanted to do so in the future, potential claimable areas for resources would be the remaining unclaimed portion of the Amerasia basin,[14] which contains 3.8% of the undiscovered Arctic oil (see Table 2). While this constitutes the majority of Arctic oil and gas in unclaimed international territory, it only amounts to the equivalent of 6 months of U.S. oil consumption in 2010.[15]

Estimate of Total Undiscovered Arctic Oil and Gas:
Oil: 89,983.21 million barrels (~34% of Saudi Arabia's proven reserves[16])
Gas: 1,668,657.82 billion cubic feet

Table 1: Undiscovered Arctic Oil & Gas within Existing Territories and ECS claims

	By Territory		By ECS Claim	
Country	**Oil Percentage**	**Gas Percentage**	**Oil Percentage**	**Gas Percentage**
Canada	11.2%	4.2%	---	---
Denmark	14.6%	6.9%	0%	0%
Iceland	0.3%	0.1%	0%	0%
Norway	4.7%	5.3%	0.6%	1.3%
Russia	**29.2%**	**66.1%**	**2.2%**	**2.8%**
United States	**32.6%**	12.8%	---	---

Note: Finland and Sweden do not have any Arctic oil & gas within their territories and were omitted from the table.

Table 2: Undiscovered Arctic Oil & Gas in Unclaimed/International Territory

Unclaimed/International Resources	Oil Percentage	Gas Percentage
All oil & gas in international territory	4.4%	1.6%
Amerasia Basin (unclaimed portions)	3.8%	1.2%

Note: The Amerasia Basin is a potential ECS claim the U.S. could make, if it ratified the UNCLOS. However, Canada may also be able to claim portions of this as it borders their EEZ.

Table 3: Undiscovered Arctic Oil & Gas within Existing Territories (the table below sorts table 1 by largest holdings)

Territory	Oil Percentage
United States	**32.6%**
Russia	**29.2%**
Denmark	14.6%
Canada	11.2%
Norway	4.7%
Iceland	0.3%

Territory	Gas Percentage
Russia	**66.1%**
United States	12.8%
Denmark	6.9%
Norway	5.3%
Canada	4.2%
Iceland	0.1%

Note: Finland and Sweden do not have any Arctic oil & gas within their territories and were omitted from the table.

Table 4: Undiscovered Arctic Oil & Gas within ECS Claims (sorted like table 3)

ECS Claim	Oil Percentage	Gas Percentage
Russia	2.2%	2.8%
Norway	0.6%	1.3%
Denmark	0%	0%
Iceland	0%	0%

Note: Canada and the United States have not made claims on their extended continental shelf (ECS).

Figure 3: Distribution of Undiscovered Arctic Oil

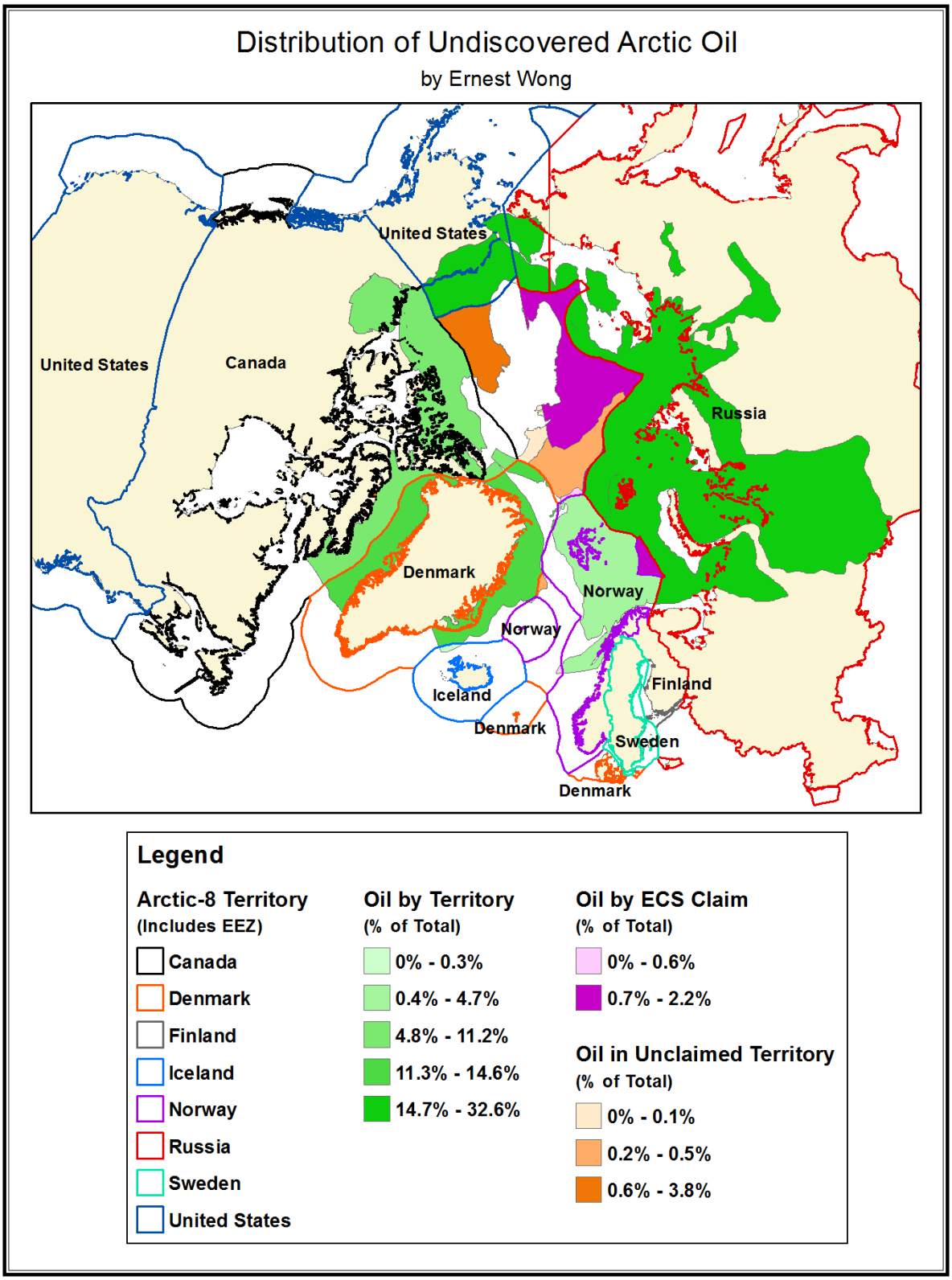
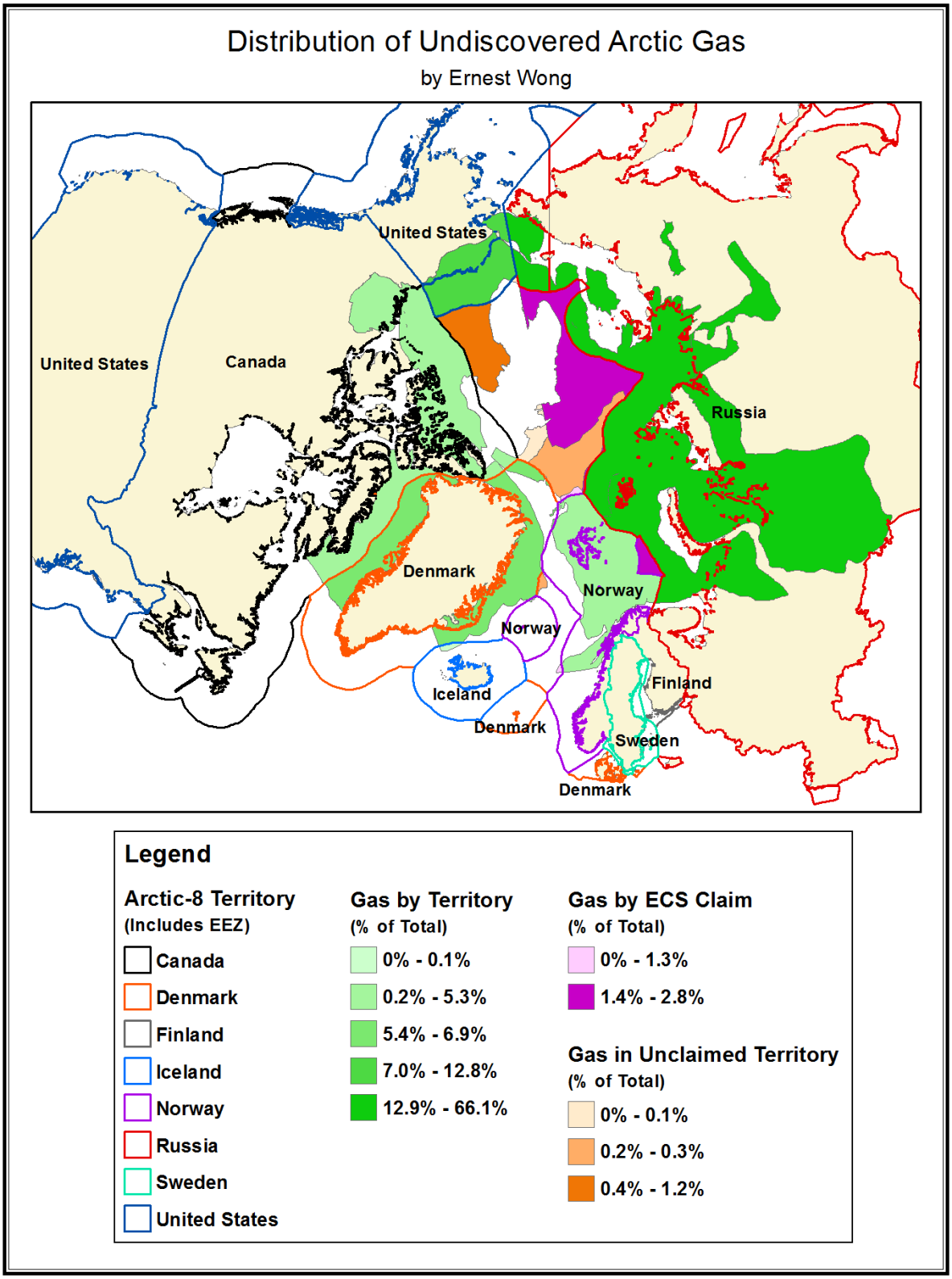


Figure 4: Distribution of Undiscovered Arctic Gas



Conclusion

The primary purpose of this analysis was to determine who owned what resources and how much ECS claims mattered. A secondary purpose was to assist U.S. policymakers with their Arctic policy. From the findings of the analysis, there are three important conclusions that alter the geopolitics of Arctic energy resources:

First, while Russian ECS claims to vast portions of the Arctic are controversial and viewed by some countries as overreaching, from the perspective of oil and gas resources, ECS claims should not be a major point of contention as they do not contain significant amounts of either resource. Instead, the findings shift the geopolitical importance of Arctic oil and gas away from ECS claims and toward existing territories, as the existing territories of U.S. and Russia contain two-thirds of all undiscovered Arctic oil and gas.

Second, the U.S. has little reason to ratify the UNCLOS for the purpose of securing Arctic energy resources, as there are few resources within the U.S.'s potential ECS claim. Attempting to ratify the UNCLOS would consume significant time and political resources that could be spent addressing other important Arctic issues, such as ownership of the Northwest Passage and Northern Sea Route, funding of polar icebreakers, and assessing and building appropriate levels of Arctic disaster response capability.

Third, Greenland (an autonomous country within the Kingdom of Denmark) has the potential to be an important player in future Arctic discussions. Greenland is the third largest holder of undiscovered Arctic oil and gas and it possesses one of the world's largest deposits of rare earth minerals (an increasingly important resource in our modern electronic society).[17] And with Greenland keen on selling its oil, gas, and rare earth minerals to achieve financial independence from Denmark,[18] Greenland is the free agent of Arctic resources. The U.S. and

Russia are undoubtedly the major actors in Arctic geopolitics, but their actions are also relatively predictable. Greenland, on the other hand, is an uncertain but important actor with significant holdings of Arctic oil, gas, and rare earth minerals.

Notes

[1] The U.S. must ratify the UNCLOS (*United Nations Convention on the Law of the Sea*) in order to make extended continental shelf claims. United Nations,. (December 10, 1982). For details see: https://www.un.org/depts/los/convention_agreements/texts/unclos/UNCLOS-TOC.htm.

[2] Ronald O'Rourke, *Changes in the Arctic: Background and Issues for Congress* (Congressional Research Service, February 27, 2012).

[3] Ibid.

[4] United Nations, *United Nations Convention on the Law of the Sea*. (December 10, 1982). https://www.un.org/depts/los/convention_agreements/texts/unclos/UNCLOS-TOC.htm.

[5] Kenneth J. Bird et al., *Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle* (U.S. Geological Survey, 2008), http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf.

[6] As mentioned earlier, the appraisal was of technically recoverable oil and gas. Economic considerations were not part of the estimate.

[7] Resolution differences create misalignment at the edges, which can cause adjacent layers to overlap slightly.

[8] The assumption of uniform distribution would be problematic if the resources were concentrated in one part of the geological formations. However, since oil/gas reservoirs tend to extend long distances, the resources will be fairly spread out. This makes the assumption less problematic, though still an issue.

[9] "Ground truthing" is a calibration method to verify remote sensing (e.g. satellite imagery measurements) with surface observations (e.g. ground measurements).

[10] For clarification, the ±2% error should not be confused to mean that the analysis results are off by 2 percentage points. Since the analysis results are in units of percent, the 2% error is a percentage of a percent. Example (a): 2% of 1% = 0.02%; example (b): 2% of 3% = 0.06%

[11] All projections produce distortions due to the nature of transforming a 3D sphere (the Earth) into a 2D surface (a map). North Pole Lambert Azimuthal Equal Area is a type of

projection that preserves area but distorts shape and distance. This projection was used because the method of analysis required accurate estimation of areas.

[12] As all projections have distortions, converting between different projections can produce additional distortions. However, the source and target projections here are very similar (azimuthal), so this is of minimal concern.

[13] Unprojected data are stored in a 3D spherical coordinate system and therefore do not have distortions. They still require projection to be properly mapped, however.

[14] See "Note 2" in Figure 6a (Appendix B). This is easily determined by visual inspection of the geo-processed data.

[15] "Country Comparison :: Oil - Consumption," *CIA - The World Factbook*, est 2010, https://www.cia.gov/library/publications/the-world-factbook/rankorder/2174rank.html.

[16] "OPEC Share of World Crude Oil Reserves," *Organization of Petroleum Exporting Countries (OPEC)*, 2010, http://www.opec.org/opec_web/en/data_graphs/330.htm.

[17] Michael Bennet. "Greenland Minerals poised to move on Kvanefjeld rare earths plan." *The Australian*, September, 09, 2010. http://www.theaustralian.com.au/business/mining-energy/greenland-minerals-poised-to-move-on-kvanefjeld-rare-earths-plan/story-e6frg9df-1225917279706.

[18] "Greenland takes step toward independence from Denmark." *The Telegraph*. June 21, 2009. http://www.telegraph.co.uk/news/worldnews/europe/greenland/5594140/Greenland-takes-step-toward-independence-from-Denmark.html.

APPENDIX

Appendix A – Data Sources

1 - USGS Arctic Resources
Source: U.S. Geological Survey
Year: 2008
Title: Geologic Provinces of the Circum-Arctic, 2008 (north of the Arctic Circle)
Download link: http://certmapper.cr.usgs.gov/data/we/arctic/spatial/shape/cara_prov.zip
Shape File: cara_prov.shp
Projected Coordinate System: Clarke_1866_Stereographic_North_Pole

2 - World Map
Source: APRS World (http://aprsworld.net/)
Year: 2009
Download page: http://aprsworld.net/gisdata/world/
Download details: world-modified.zip
Download link: http://aprsworld.net/gisdata/world/world-modified.zip
Shape File: world.shp
Geographic Coordinate System: NAD27

3 - EEZ
Source: VLIZ Maritime Boundaries Geodatabase
Date: 2011-05-12
Version: v6.1 Low Resolution
Download location: http://www.vliz.be/vmdcdata/marbound/download.php
Shape File: World_EEZ_v6_1_simpliefiedcoastlines_20110512.shp
Geographic Coordinate System: GCS_WGS_1984

4 - ECS Submissions
Source: UNEP Shelf Programme
Date: 2012-01-18
Download page: http://continentalshelf.org/onestopdatashop/4204.aspx
Download details: CLCS list of all submissions / polygon files
Direct link: http://hisoya.grida.no/continental.shelf/Shapefiles/ecs_polygons.zip
Shape File: ECS_Submissions.shp
Geographic Coordinate System: GCS_WGS_1984

Appendix B – Work Flow Charts

Figure 5a: Data Preparation Work Flow Chart

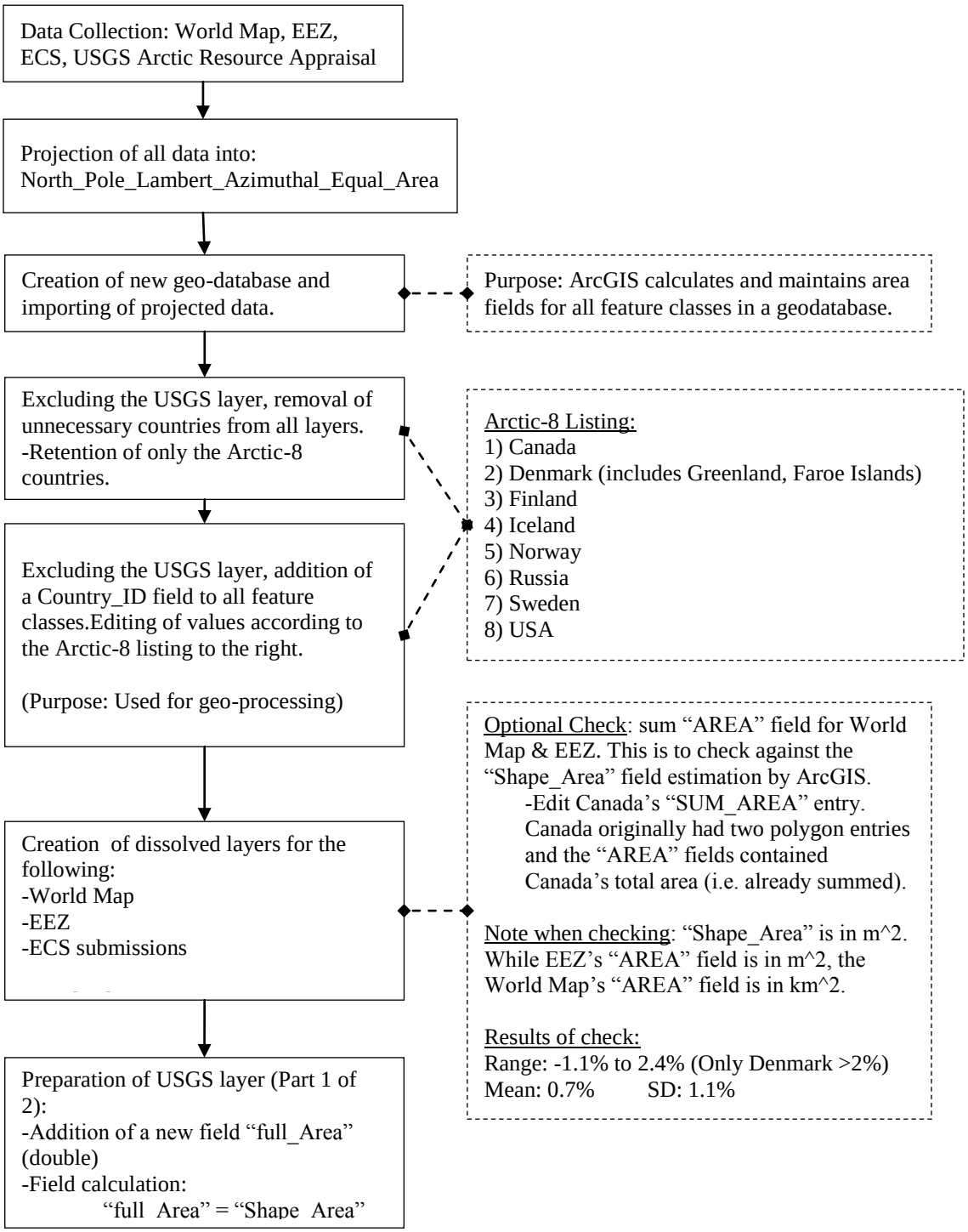


Figure 5b: Data Preparation Work Flow Chart (continued)

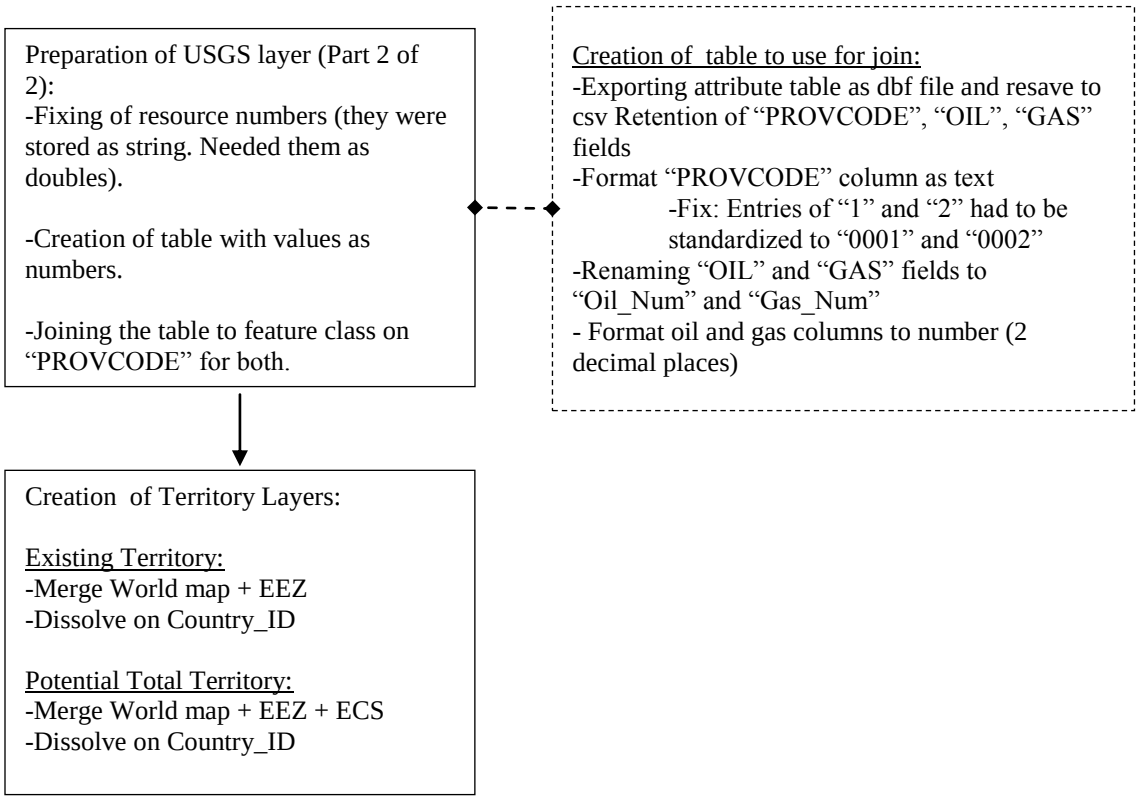


Figure 6a: Analysis Work Flow Chart

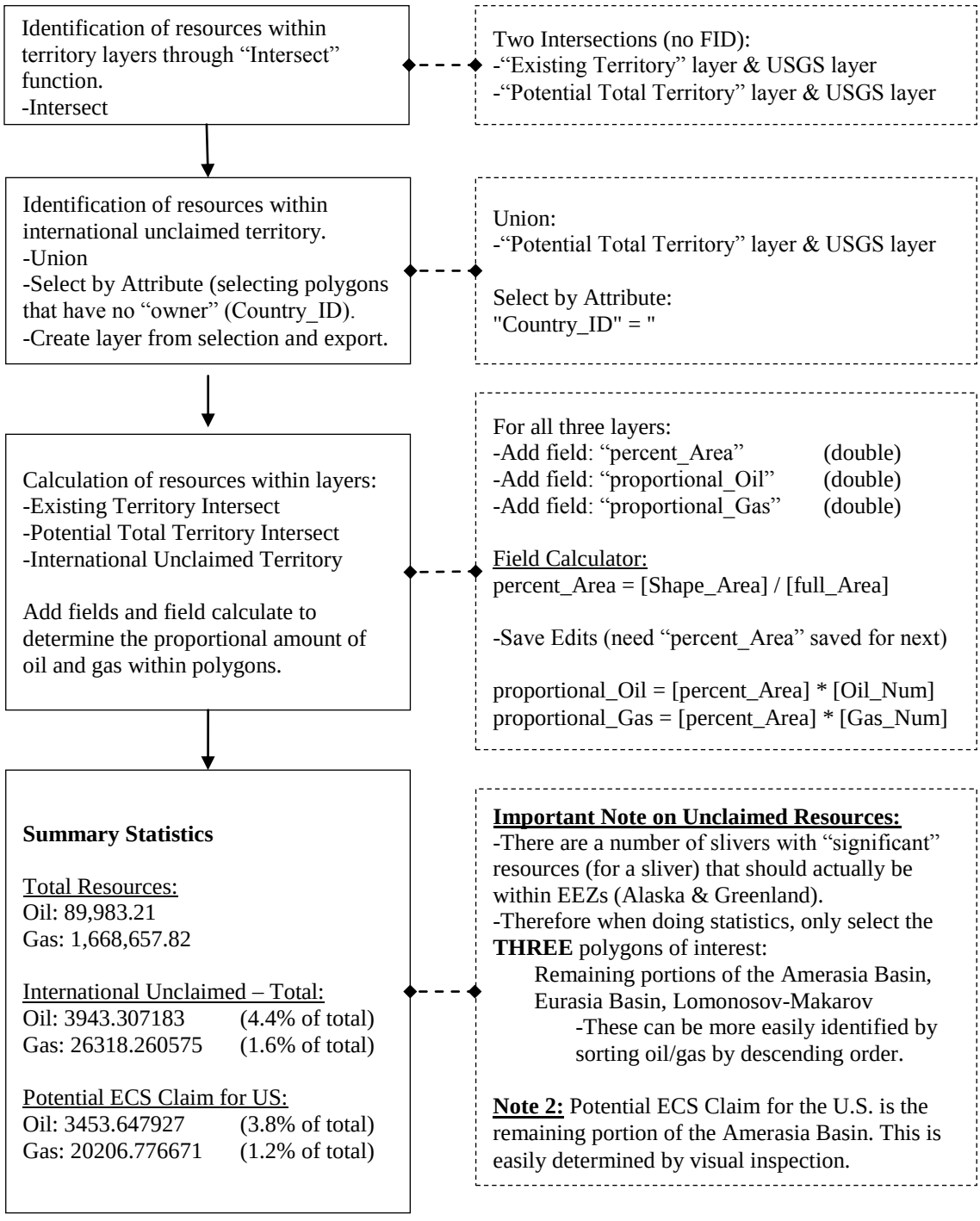
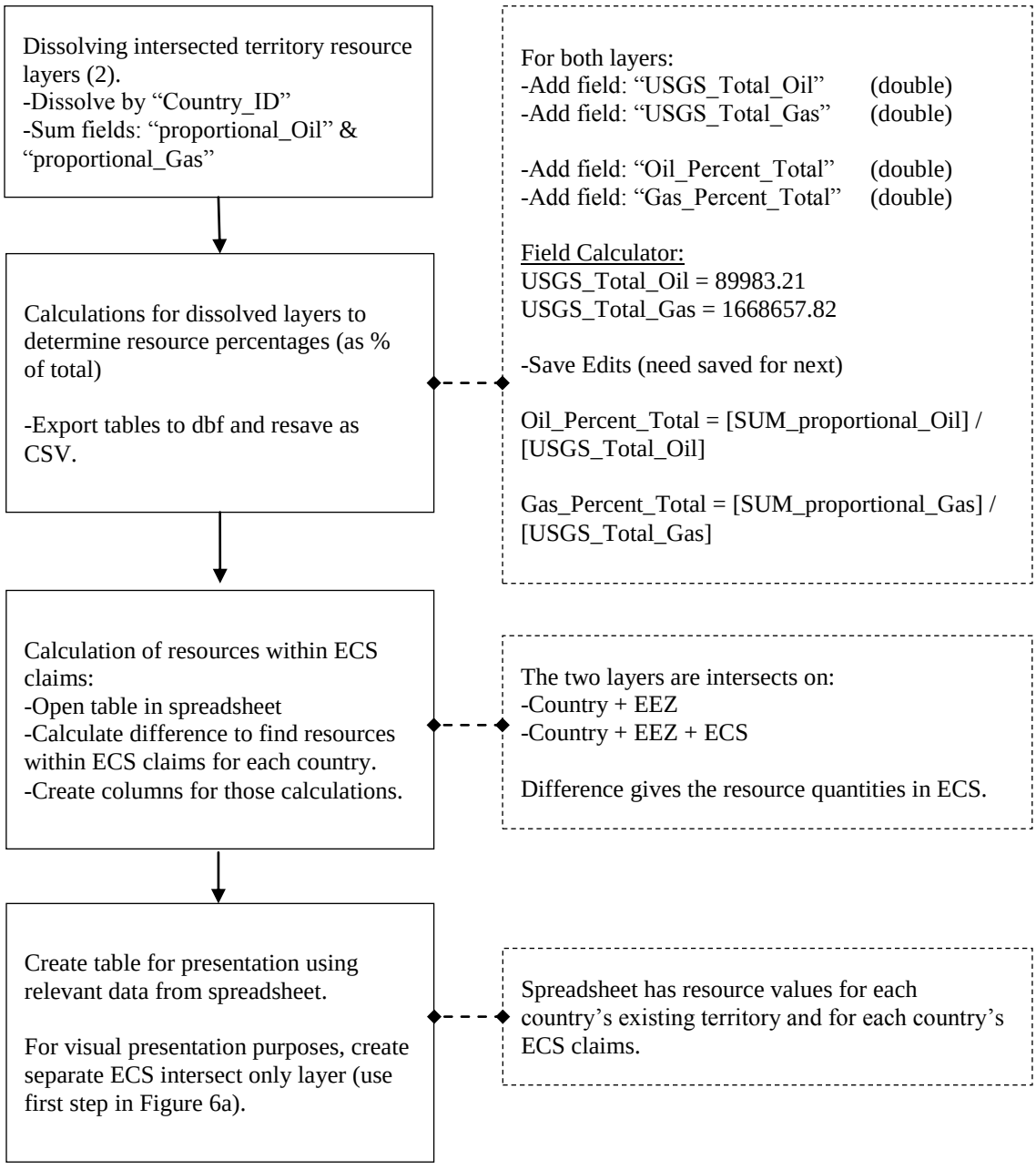


Figure 6b: Analysis Work Flow Chart (continued)



APPENDIX C

Figure 7: GIS Visualization of Data Layers

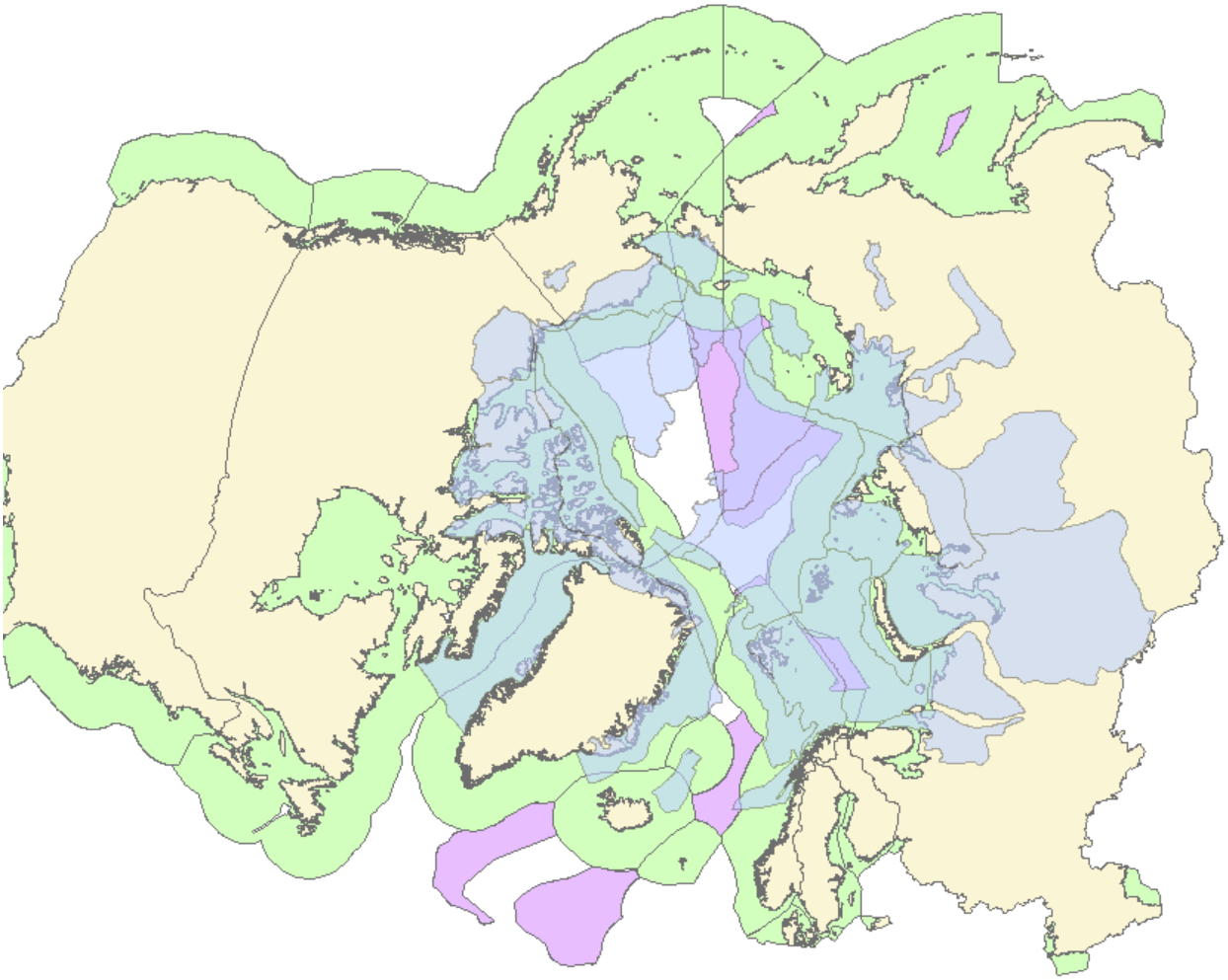


Figure 7 overlays the four data layers used in the analysis.

The data layers are represented by the following colors:

Khaki: Land
Green: EEZ
Purple: ECS claim
Blue (semi-transparent): Geological provinces from USGS appraisal

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