Boundaries and Sovereignty Encyclopedia (BASE)

SpaceTimeIDs: A novel approach for tracking boundary changes over time

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Office of the Geographer and Global Issues (GGI)

• 100th year of the Office’s founding

• Cartographic Production and Place Names

• Large Scale International Boundaries (LSIB)

• Boundaries and Sovereignty Encyclopedia (BASE)

• Senior Agency Official for Geospatial Information (SAOGI) and responsibilities under the Geospatial Data Act of November, 2018
Office of the Geographer and Global Issues (GGI)

• Critical Questions...

• How to move LSIB data production and GIS workflows forward in terms of sophistication, scalability, and dissemination?

• How to leverage the massive amount of modern and historical information on boundary lines and associated documents?

• How to increase value and accessibility for consumers of boundary information?
Large Scale International Boundaries (LSIB)

• These data and their derivatives are the only international boundary lines approved for U.S. Government use. They reflect U.S. Government policy, and not necessarily de facto limits of control.

• Sources for these data include treaties, relevant maps, and data from boundary commissions and national mapping agencies. Where available, the dataset incorporates information from courts, tribunals, and international arbitrations.

• The research and recovery of the data involves analysis of satellite imagery and elevation data.
Large Scale International Boundaries (LSIB)

• The LSIB are a US National Geospatial Data Asset (NGDA) and are a core layer of the National Spatial Data Infrastructure

• The LSIB data are publicly released as open data on the State Department geospatial data portal:
  • Webpage: https://geonode.state.gov/layers/catalog:geonode:LSIB
  • Data download: https://data.geonode.state.gov/LSIB.zip
Large Scale International Boundaries

Title
Large Scale International Boundaries

License
Public Domain / USG (PD/USG)

Abstract
The Office of the Geographer and Global Issues at the U.S. Department of State produces the Large Scale International Boundaries (LSIB) dataset, currently at Version 11.1 (published 22 August 2022). The 11.1 release is primarily a data refinement release, further updating the line pairs described below in the Supplemental Information section. These data and their derivatives are the only international boundary lines approved for U.S. Government use. They reflect U.S. Government policy, and not necessarily de facto limits of control. This dataset is a National Geospatial Data Asset.

Legend
Boundary Status
- International Boundary (Rank 1)
- Other Line of International Separation (Rank 2)
- Special Line (Rank 3)

Maps using this layer
This layer is not currently used in any maps.

Styles
The following styles are associated with this layer. Choose a style to view it in the preview map.
- (default style) Boundary Status

About
Responsible, Point of Contact, Metadata Author
GGI
Elements of Boundary Data

- Bilateral agreements
  - Negotiated between two entities
  - Entities change...(appear, disappear, change names)

- Grounded in legal agreements
  - Each boundary has any number of treaties and maps associated with it
  - Additionally, analysis documents and news reports may also be relevant

- Lines change over time (for several reasons)
  - New agreements
  - Better mapping data and technology
  - Entities change

- Lines are composed of smaller segments
  - Segments governed by different legal agreements
  - Status and recognition of a segment may be different
  - Multiple contrasting claims may be made over the same geographic area
Original Source: Soviet General Staff maps
Updated Source: State boundaries of Finland
(https://www.maanmittauslaitos.fi/en/stateboundaries)
Original Source: Soviet General Staff maps
Updated Source: Treaty between Ukraine and Russian Federation on the Ukrainian-Russian State border
(https://treaties.un.org/Pages/showDetails.aspx?objid=08000002803fe18a&clang=_en)
A digital boundary data archive must accomplish four fundamental tasks:

1. Manage changes in the boundary alignment / spatial geometry and attributes associated with boundary lines and segments through space and time.

2. Manage the hierarchical assembly of constituent line segments into international boundaries.

3. Maintain the linkages between the line segments and the various kinds of relevant documents (artifacts).

4. Provide visualization, search, and access functions for both boundary lines and segments and documents.
Boundaries and Sovereignty Encyclopedia (BASE)

- Official US government boundary repository
- New Version [2.0] is a fully interactive encyclopedia of officially recognized USG boundaries, policy narrative, artifacts, and geospatial data
- Cloud-hosted, internet accessible at https://statetoday.net/base
- Open to anyone in the USG with an official email
- Built to manage the entirety of the boundary and document repository in space and time
- Introduces new challenges when lines are managed as data, and not just as cartography
- Revised production, GIS, and dissemination workflows
- Required a new model of data management and a new concept of SpaceTimeIDs
**Challenges: LSIB, BASE, GIS, and SpaceTimeIDs**

- Tracking change over time in the boundary data, both in terms of spatial alignment and attributes, requires specific geospatial workflows and versioning.

- Building a digital repository of associated documents, with the appropriate data tagging and organizational schema.

- Building a web application that unifies the spatial data with the document repository and provides visualization, search, and access at all levels of boundary data.

- Maintaining links between changing boundary lines and document library.
SpaceTimeIDs

- Developed to solve the problem of linking changing boundaries to relevant documents

- Adapted from distributed version control systems used to manage software code (Git) and geospatial data (GeoGig)

- Leverages Universally Unique Identifiers (UUIDs) to encode the spatial and attribute configuration of a line segment at a point in time

  - Example: 123e4567-e89b-12d3-a456-426614174000
  - Citation - https://en.wikipedia.org/wiki/Universally_unique_identifier#Version_4_(random)
  - Citation - https://www.iso.org/standard/53416.html
The Ethiopia-Somalia International Boundary has 3 segments with 2 different values for “Status” and “Rank”. These are expressed both cartographically and in the data.
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Each line segment in the Ethiopia-Somalia boundary has a unique SpaceTimeID (ID_1).

Additionally, the ParentID links the two line segments together, allowing the entire International Boundary to be logically combined on the BASE web page.

Because there was no change in these lines between LSIB 10.2 and LSIB 11.1, the PreviousID remains the same as the current ID.
Each line segment in the Ethiopia-Somalia boundary has a unique SpaceTimeID (ID_1).

Additionally, the ParentID links the two line segments together, allowing the entire International Boundary to be logically combined on the BASE web page.

Because there was no change in these lines between LSIB 10.2 and LSIB 11.1, the PreviousID remains the same as the current ID.
SpaceTimeIDs and Search

• SpaceTimeIDs allow a linkage between a document and a specific instance of a boundary line.

• The collection of SpaceTimeIDs (in the form of the PreviousID field) allows the database to understand that a document tagged as relevant to a specific boundary line (SpaceTimeID) is also relevant to a later version of that even...even if every other variable changed.

• For example, how would a treaty between Yugoslavia and Hungary be discovered in a search for relevant documents between Croatia and Hungary?
BASE Organization / Web Application

- **Lines and geospatial data** in LSIB, global maritime limits and boundaries format

- **Boundary pages** with narrative information about each boundary, linked artifacts, and map of the boundary

- **Country pages** that show boundaries for a country or territory

- **Artifact files** like treaties, pictures, and articles that provide context to geospatial and narrative data
BASE Home Page

• Explore BASE by country
  • Clickable map with links to country pages

• Discover boundary type navigation hubs
  • Global land boundaries
  • Global maritime boundaries
  • Global maritime limits
Country Pages

- Find all boundary information for each country in the world.
- Interactive map to discover individual boundaries
- Tables of all a country’s boundaries
- Country-level boundary narratives
Brazil - Colombia – Land Boundary Pair
land boundary pair

Overview

MAP OF BRAZIL’S FIRST-ORDER ADMINISTRATIVE DIVISIONS:

The Office of the Geographer and Global Issues has reviewed the attached first-order division map produced by the CIA and believes it reflects the current administrative structure of this political entity. This map is to be used solely for reference and small-scale cartographic applications.

Names shown are those approved by the US Board on Geographic Names (BGN) at the date of the map’s publication but may not be current. Please consult the BGN database to verify toponymic changes (Products and Services --> GeoNet Names Server).

Unresolved administrative boundaries: Brazilian maps at larger scales have shown remote areas between Para and Amazonas states (24) and Ceara and Piauí states (40, 34) in a manner indicating that portions of these administrative boundaries are unresolved. The official state maps at (40), however, do not show any gap between Para and Amazonas, while still showing an unresolved area between Ceara and Piauí states. Pending official evidence, the Office of the Geographer recommends depiction of only the three section of unresolved boundary between Ceará and Piauí states.
BASE by Boundary Type (Pages)

• View land boundaries, maritime boundaries, and maritime limits across the globe

• Discover and navigate to pages for specific boundaries
France - United Kingdom – Maritime Boundary Pair
maritime boundary pair
Portugal (Extended Continental Shelf Limit)
maritime limit
Boundary and Segment Pages

• Dedicated pages for each land and maritime boundary, maritime limit, and segment

• Sourced narrative information describing the boundary and history

• Discover all “artifact” documents that provide historical context for a boundary

• “Child” segments of a boundary shown geospatially and in clickable table

Overview

PHYSICAL DESCRIPTION:

• **Segment 1 [NORTHERN SEGMENT]**: Beginning at the Djibouti tripoint on Madaha Djalelo hill at approx. 105955N 0425805E, the boundary connects to hilltops until 9N 044E, where it extends in a straight line to 8N 047E, and then along the parallel to 048E. This section was demarcated between 1929 and 1934.

• **Segment 2 [CENTRAL SEGMENT]**: Beginning at 8N 48E, the provisional administrative line runs SW in largely straight line segments connected to points associated with primarily populated places until the town of Dolo Odo (Dolo).

• **Segment 3 [SOUTHERN SEGMENT]**: Boundary follows the thalweg of the Daua/Dawa Wenz (Dewa) river from its confluence with the Genale Wenz (Ganale-Dorya) at the town of Dolo Odo to the Kenya tripoint (cf: ET:KE treaty of 9 Jun 1970).
Ethiopia – Somalia – Land Boundary Pair

Segments

Ethiopia - Somalia (Provisional Administrative Line; Other Line of International Separation)

effective

Overview

PHYSICAL DESCRIPTION:

- **Segment 1 [NORTHERN SEGMENT]**: Beginning at the Djibouti tripoint on Madaga Djialeko hill at approx. 105955N 042580S, the boundary connects to hilltops until 9N 044E, where it extends in a straight line to 8N 044E, and then along the parallel to 048E. This section was demarcated between 1929 and 1934.
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- **Segment 3 [SOUTHERN SEGMENT]**: Boundary follows the thalweg of the Dausa/Dawa Wenz (Dawa) river from its confluence with the Genale Wenz (Ganale-Dorya) at the town of Dolo Odo to the Kenya tripoint (cf. ET-KE treaty of 9-Jun-1970).
SpaceTimeIDs

- Access historical versions of boundaries
- View key metadata of historical boundaries
- Discover artifacts associated with historical boundaries
Search and Discovery

• Use keyword search to find pages, files, and boundaries that match your search terms

• Use geospatial search to find information within an area you draw on a map
Artifact File Repository

• View and download artifacts providing source material for boundaries
  • Treaties
  • Maps
  • News articles
  • Government reports

• Filter with keywords

• Search with tags
  • Country
  • Boundary
Maps

- Image graphic showing transition from Dawa River to provisional administrative line
- Frontier Area between Ethiopia and Trust Territory of Somalia
- Southeastern Ethiopia, Status of Boundaries - 1949
- Map 1: To illustrate the Italian and the Ethiopian Interpretations of the Convention of 16 May 1908
- Map 2: To illustrate the Italian and the Ethiopian Compromise Proposal
- Ethiopia-Somalia
- Ethiopia-Somaliland
- "Frontiers and Colonial Boundaries, 1891-1960," from Somalia: A country study, p. 15
- Servizio Cartografico del Ministero delle Colonie: "I territori della Somalia con indicazione dei luoghi e di limiti politici ad illustrare l’annata 1931, 1:3,000,000 scale (published by the United Nations in Document A/3502, Annex V, January 1957)
- Linee Telegrafiche E Telefoniche (Eritrea, Etiopia, Somalia) (Scale 1:500,000, January 1957)
- Former Italian Somaliland

**ADDITIONAL SPECIAL GUIDANCE: DEPICTION OF 'PUNTLAND' AND 'SOMALILAND' SECESSIONIST REGIONS:**

Unlike the southern portion of Somalia, which has been without a functioning government in Mogadishu since 1991, "Puntland," at the time of this writing, was a semi-autonomous region of northeastern Somalia with its own government. The breakaway region of "Somaliland," in northwest Somalia, has achieved a certain degree of autonomy and has declared independence as an alternative to "Somalia," with which it was never ethnically integrated. These two entities have been marked on maps intended to show their existence with line symbols and name types.

- These yet-recognized entities may be identified on maps intended to show their existence with line symbols and name types.
- The separation between the two entities, which is in dispute, is unclear and may or may not fall along the former Anglo-Italian boundary coordinates from surveys.

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**Treaties And Other International Acts**

- 1897 Treaty between Great Britain and Ethiopia
- 1908 Agreement between Ethiopia and Italy
- UK letter to UN Trusteeship Council defining 1950 provisional line
- Anglo-Italian exchange of notes, November 22, 1933
- Exchange of Notes between the United Kingdom and Italy respecting concessions for a barrage at Lake Tsana and a power station at Kismayu
- Anglo-Italian and Anglo-Ethiopian boundary coordinates from surveys
Roadmap

• Continued refinement and automation of the end-to-end geospatial processing for creating and disseminating the LSIB

• SpaceTimeID paper being drafted that formalizes much of the content in this talk
  • We believe the use of SpaceTimeIDs are broadly applicable to all boundaries (admin 1 and above as well as maritime)

• Overall goal is to open BASE to the public...
  • but requires a robust content review to remove any information that is limited by copyright or official use caveats
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