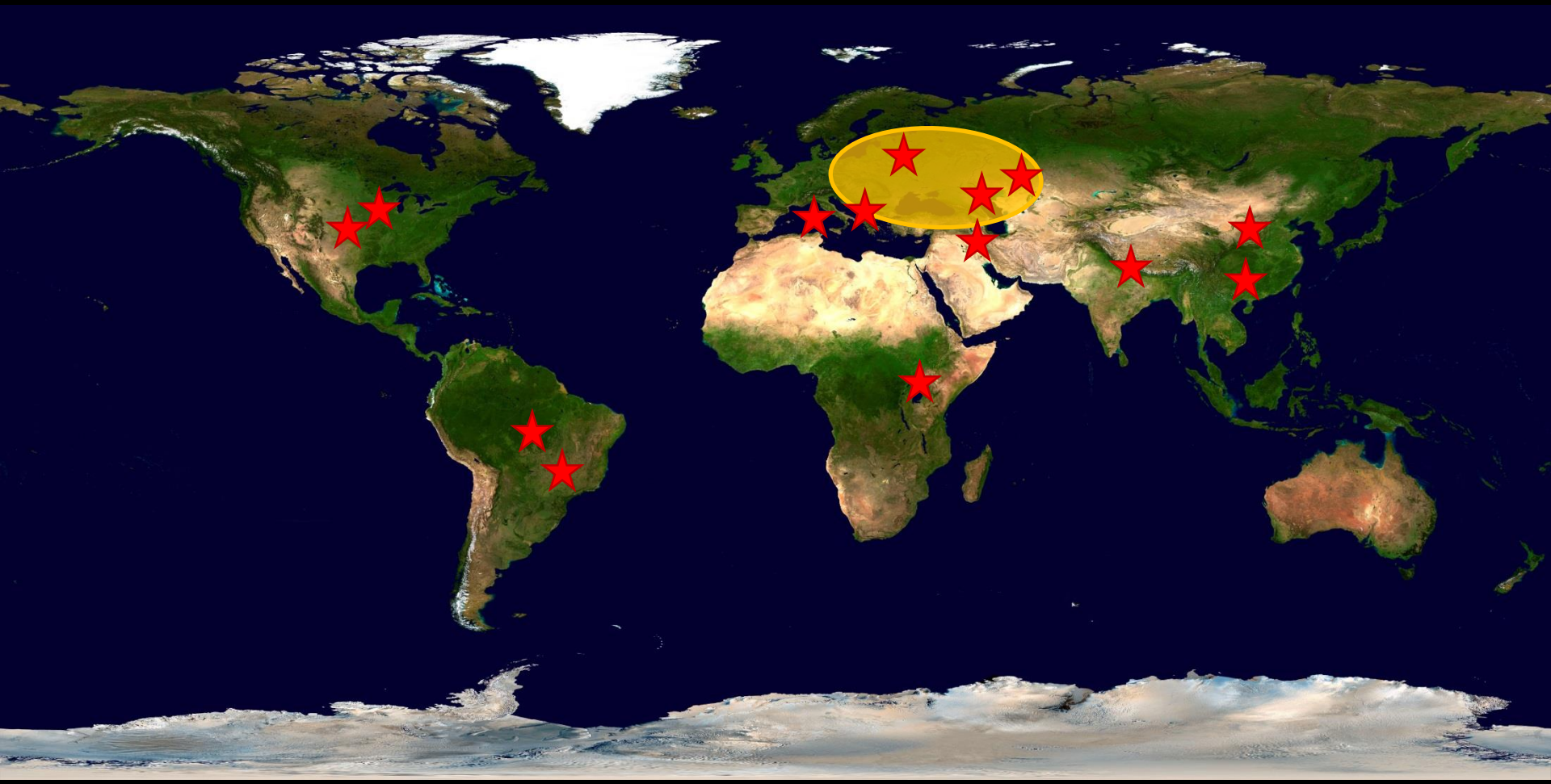
MONITORING THE DYNAMICS OF ABANDONED AGRICULTURE, FALLOW FIELDS AND GRASSLANDS

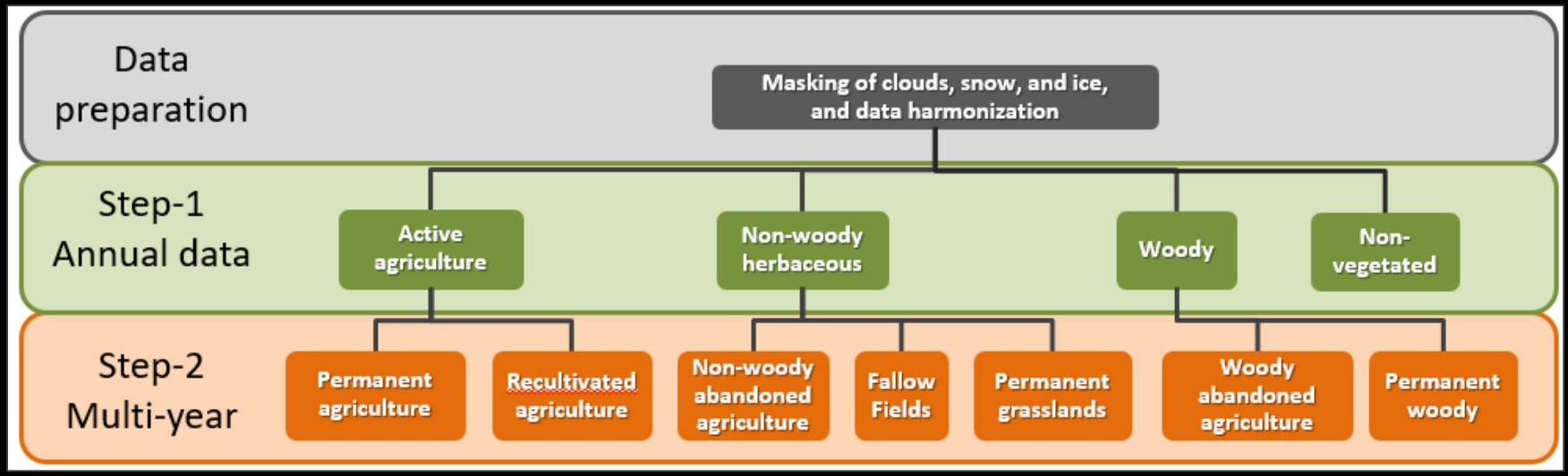
Volker C. Radeloff, H. Yin, J. Buchner, K. E. Lewinska, S. Spawn, E. Razenkova,
A. Rizayeva, N. Rogova, University of Wisconsin-Madison
Patrick Hostert, and Patrick Griffiths, Humboldt University, Berlin

LCLUC/MuSLI Science Team Meeting, 4/10/2019

Approach

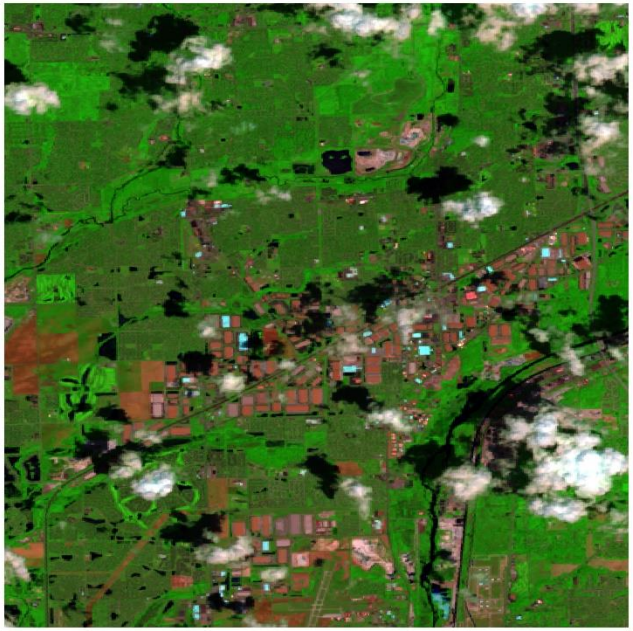


Approach


Data preparation
Masking of clouds, snow, and ice, and data harmonization
Step-1 Annual data
Active agriculture
Non-woody herbaceous
Woody
Non-vegetated
Step-2 Multi-year
Permanent agriculture
Recultivated agriculture
Non-woody abandoned agriculture
Fallow Fields
Permanent grasslands
Woody abandoned agriculture
Permanent woody

2017-02-11

2017-06-27



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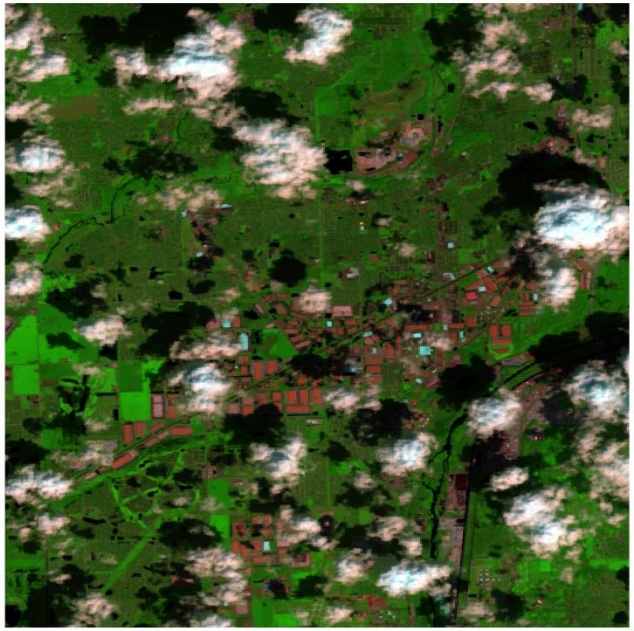

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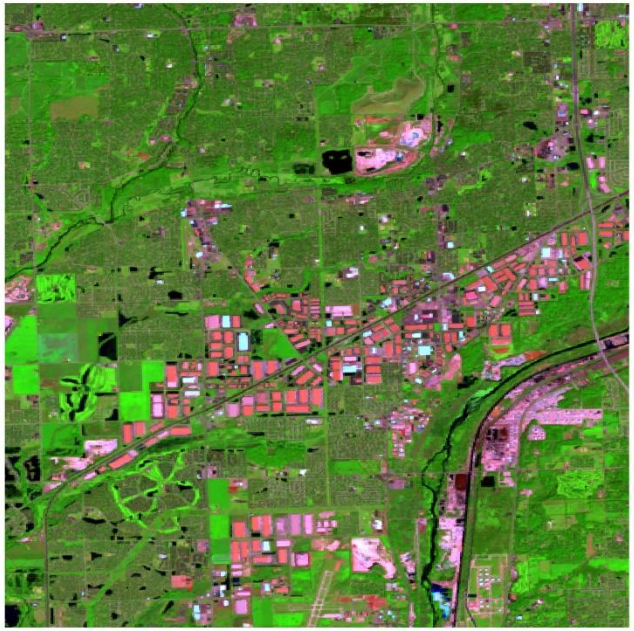

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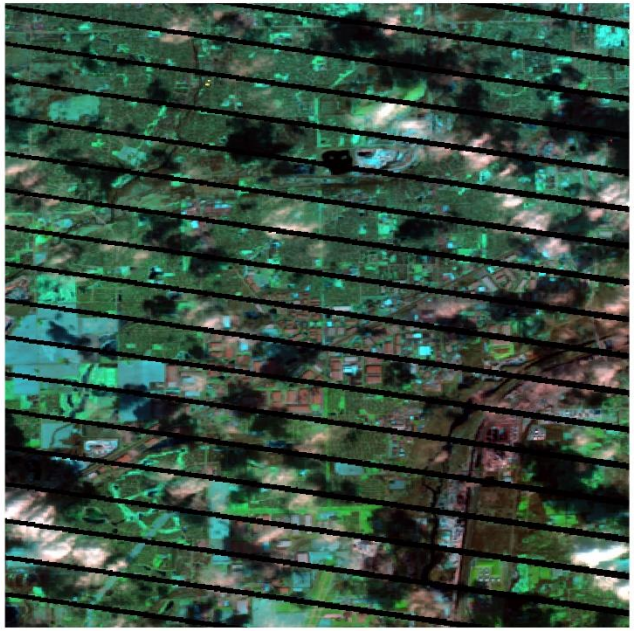
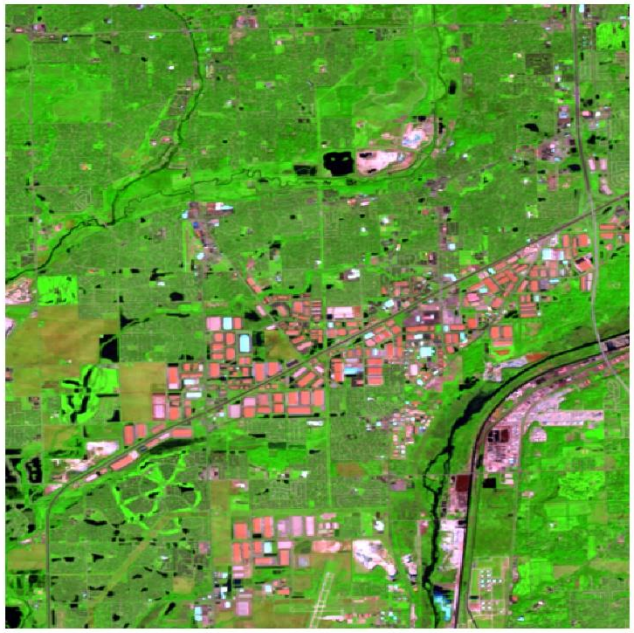
2017-12-12



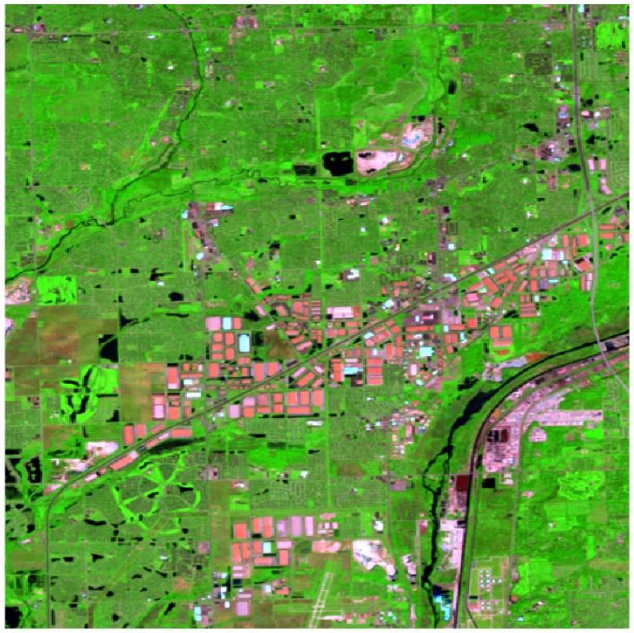
DOY	B1	B2	B3	B4	B5	B7
55	256	625	454	423	114	422
68	294	477	554	456	886	125
126	855	457	457	712	354	421
225	1600	6500	1637	7129	5193	5004
298	586	788	991	258	388	585

Metric	B1	B2	B3	B4	B5	B7
Mean	323	587	610	462	436	388
Median	275	661	506	440	371	422
Q25	155	154	156	188	324	192
Q75	367	666	663	520	513	463
Stdev	185	457	454	188	324	192

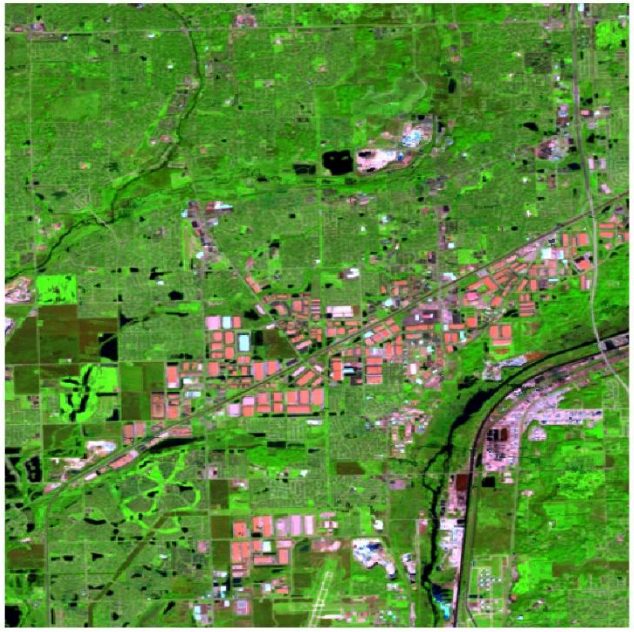
Mean



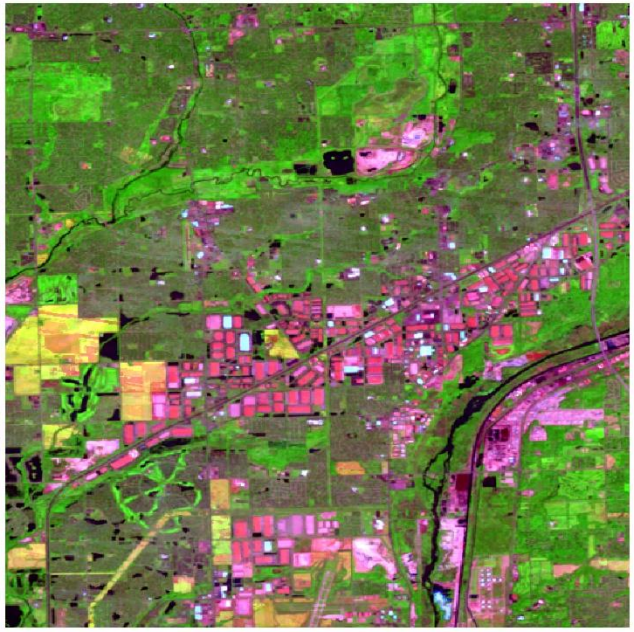
Median



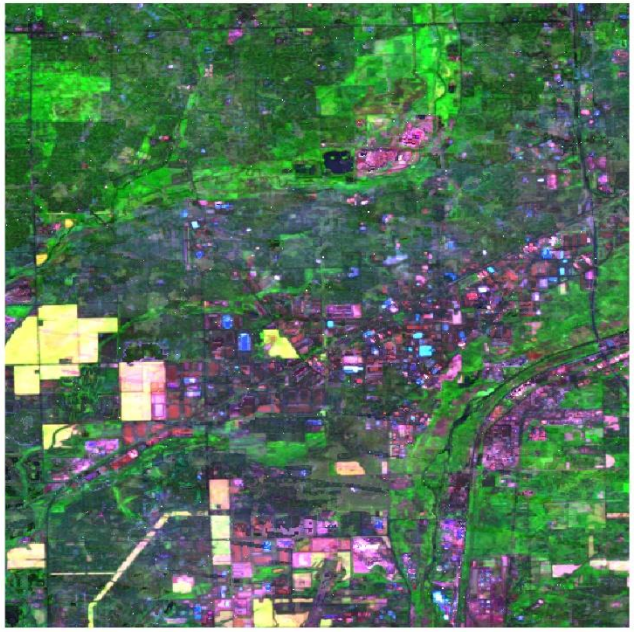
Quantile 20

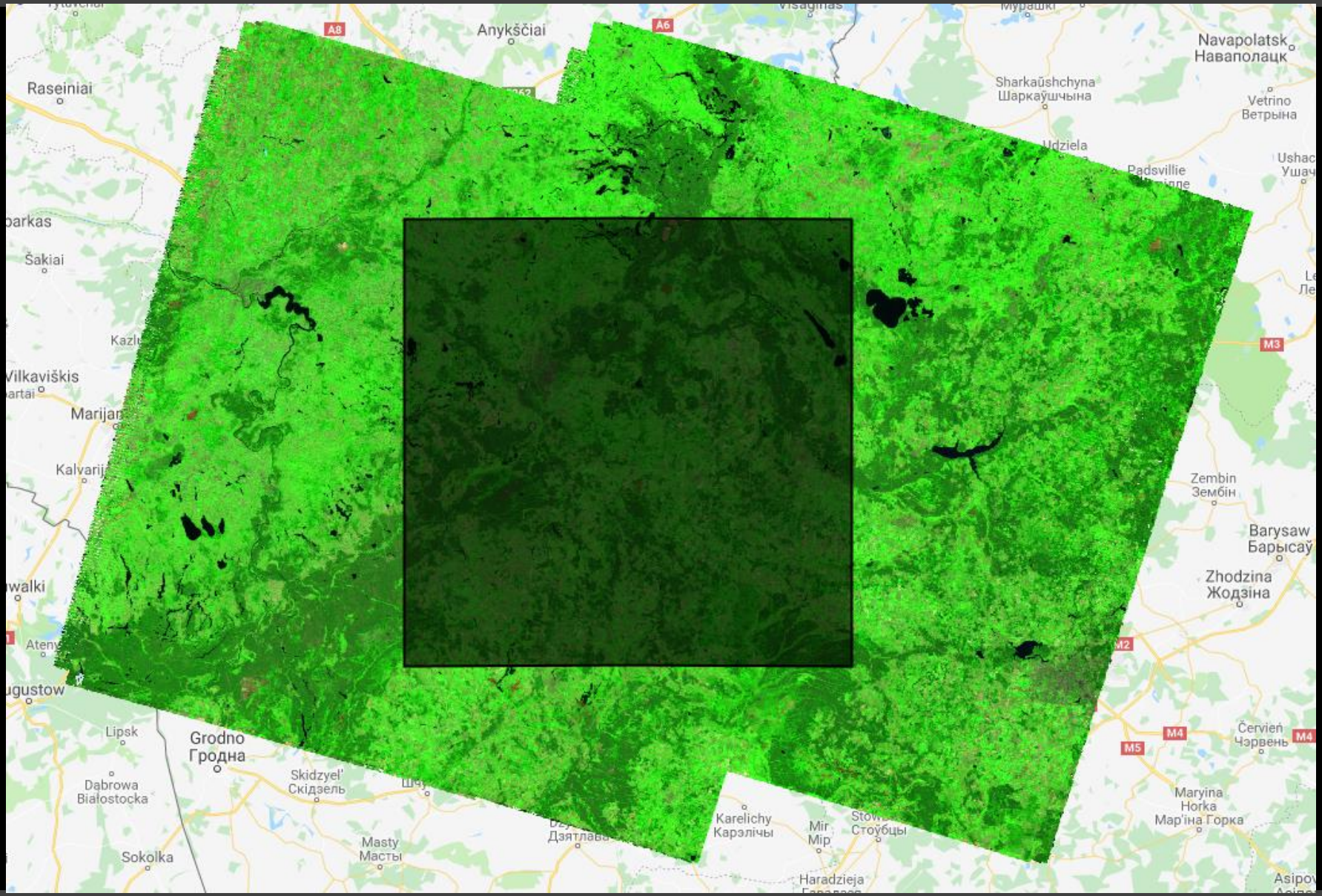


Quantile 80

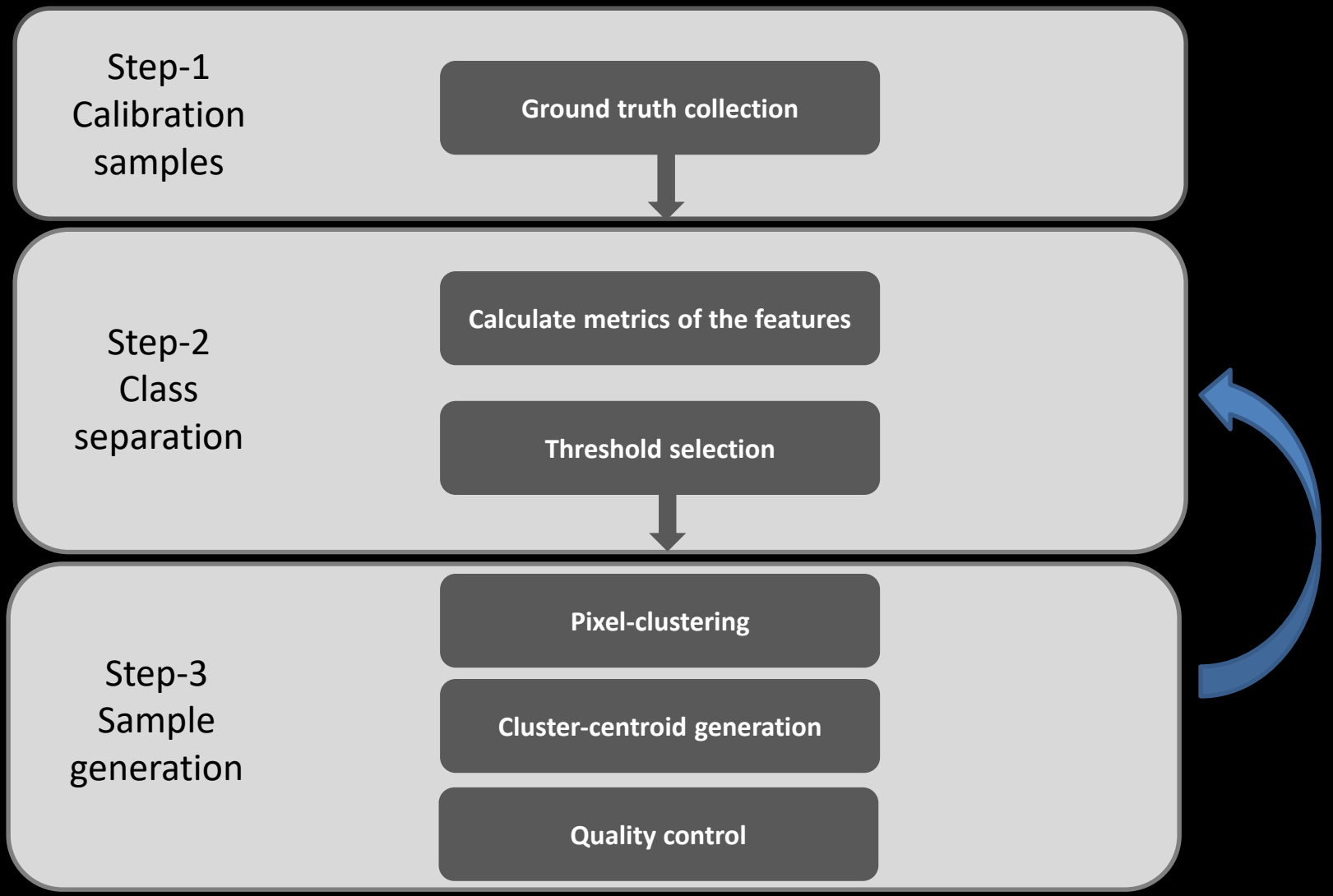


Standard deviation

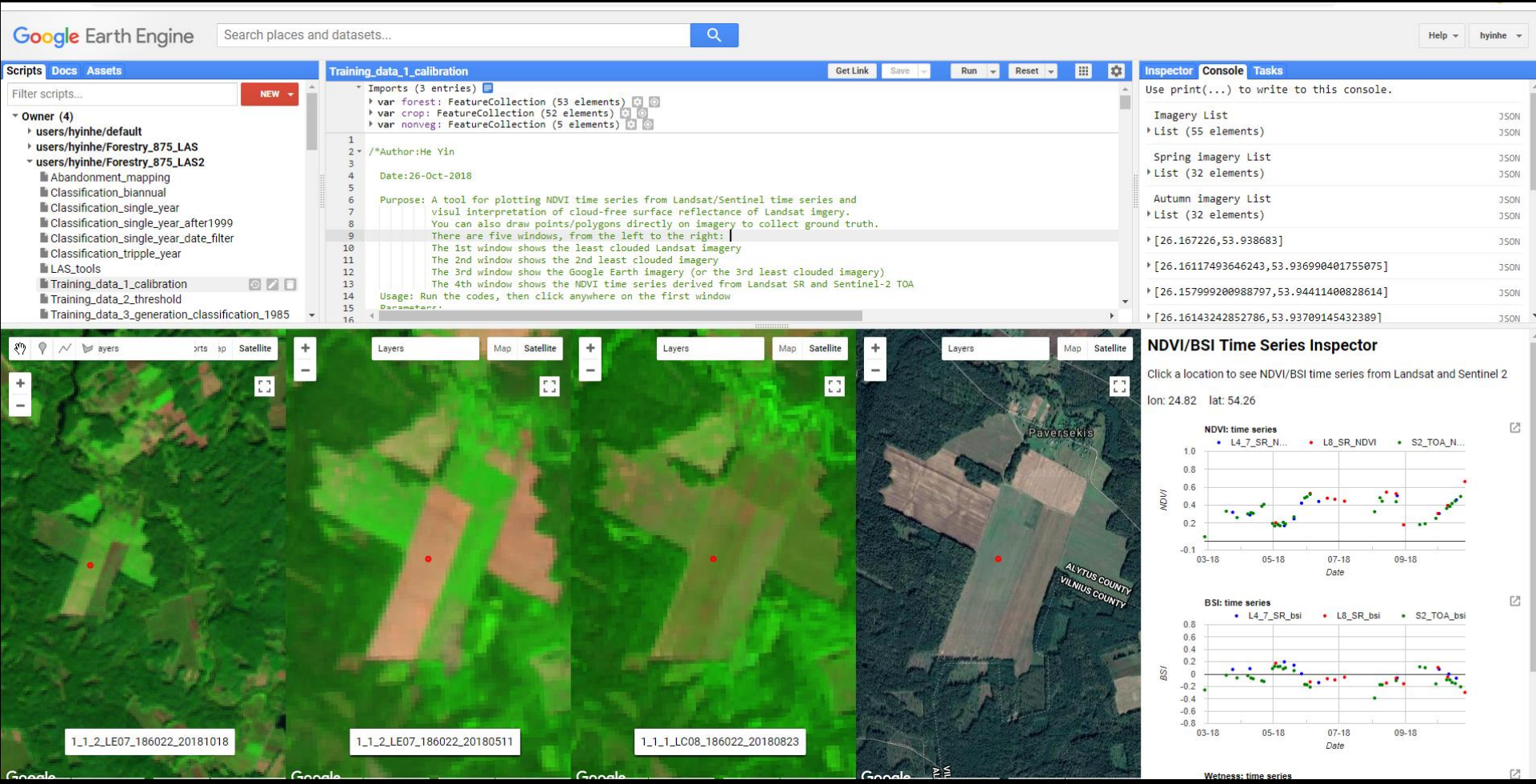



Anykščiai
Raseiniai
Navapolatsk
Наваполацк
Sharkaŭshchyna
Шаркаўшчына
Vetrino
Ветрына
Udziela
Padsvillie
Ushac
Ушач
Šakiai
Kazlų
Vilkaviškis
Marijan
Kalvarij
Zembin
Зембін
Barysaw
Барысаў
Zhodzina
Жодзіна
Ateny
Lipsk
Grodno
Гродна
Skidzyel'
Скідзель
Dąbrowa
Białostocka
Sokolka
Masty
Масты
Karelichy
Карэлічы
Mir
Мір
Haradzieja
Maryina
Horka
Мар'іна Горка
Červień
Чэрвень
A8
A6
M3
M4
M5
M2

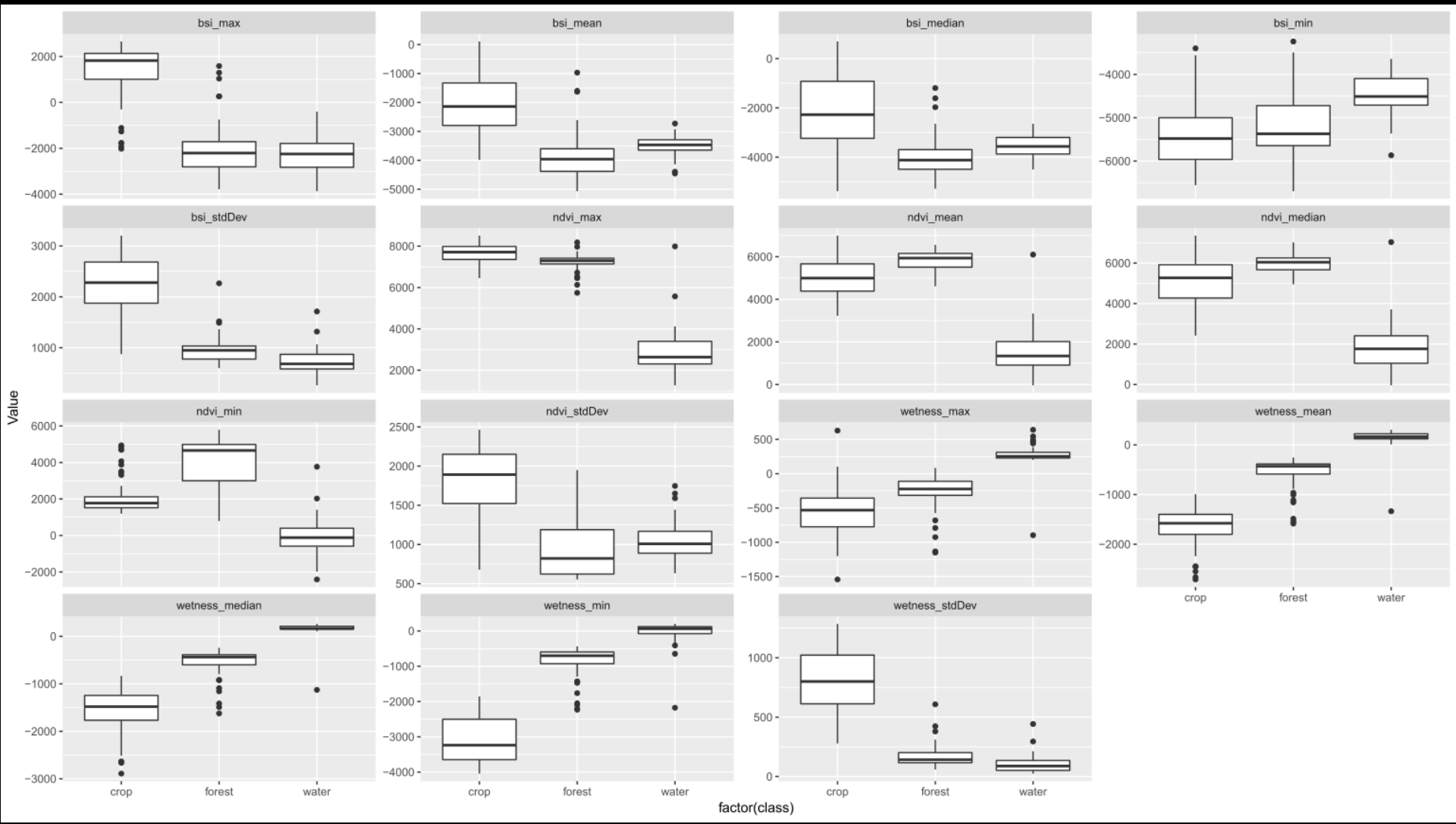
Training data generation



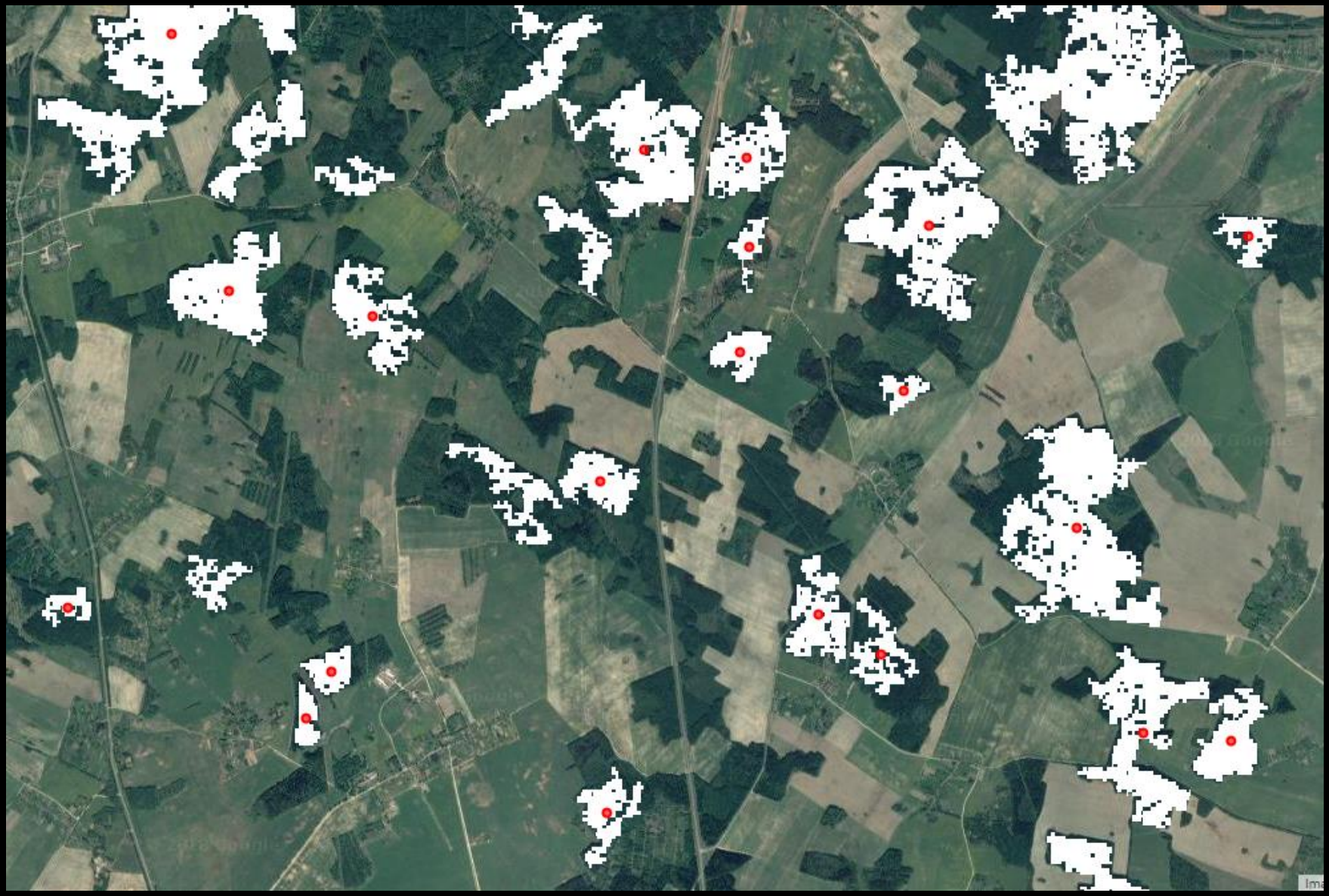
Step 1 Calibration samples



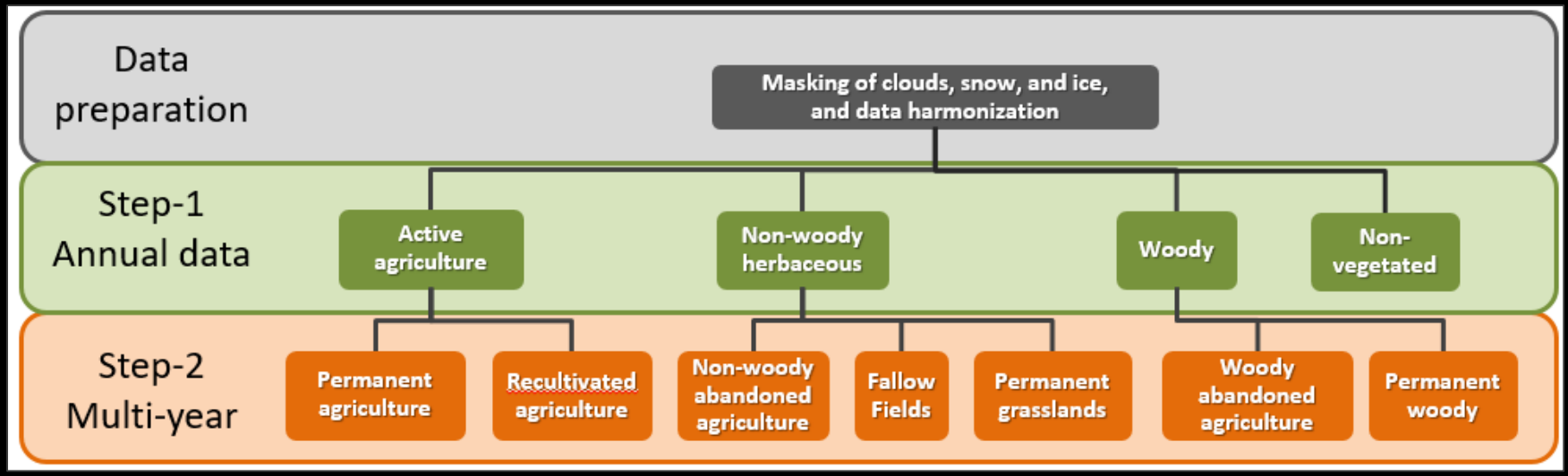
Step 2 Class separation



Step 3 Sample generation



Approach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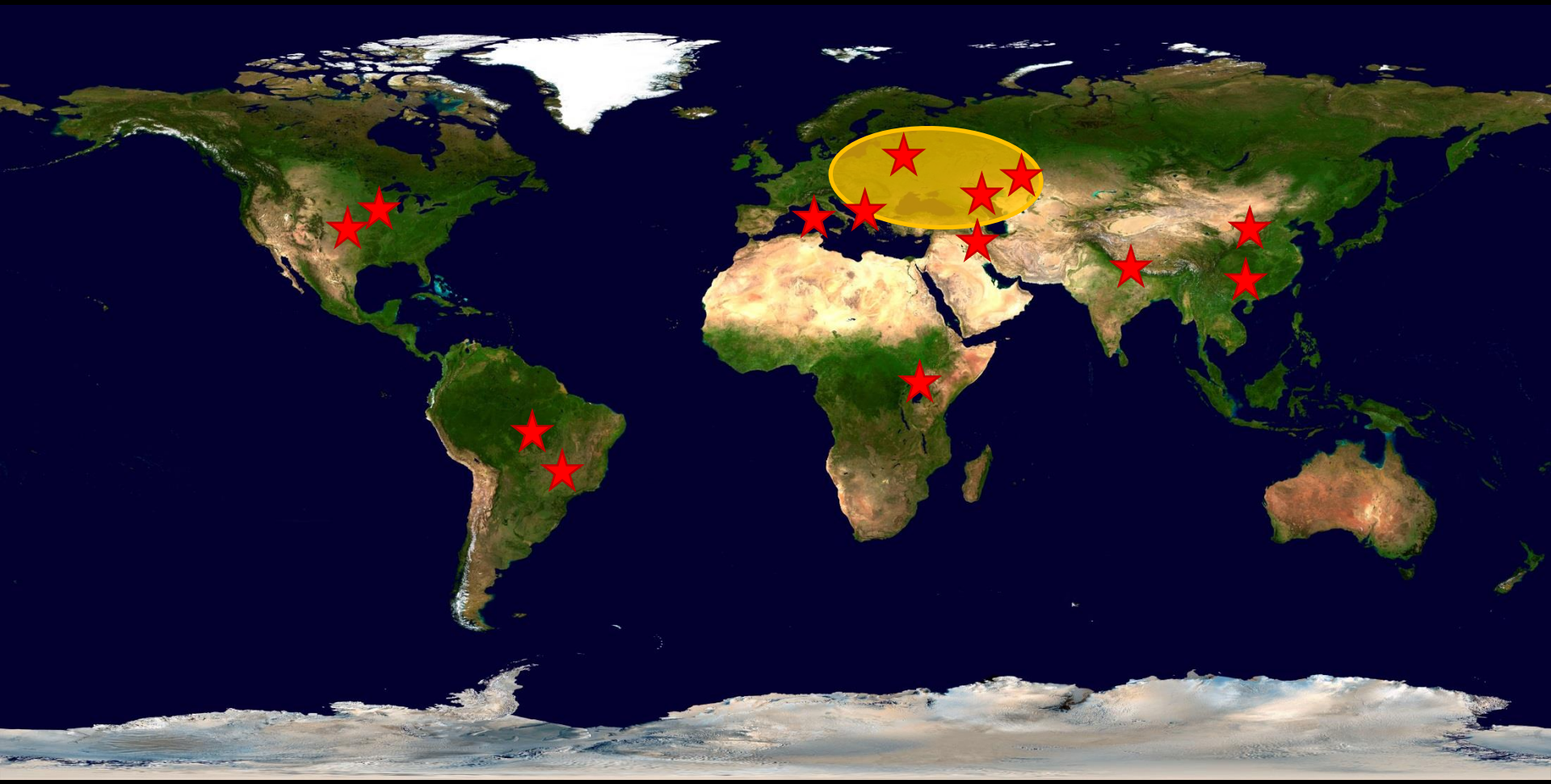
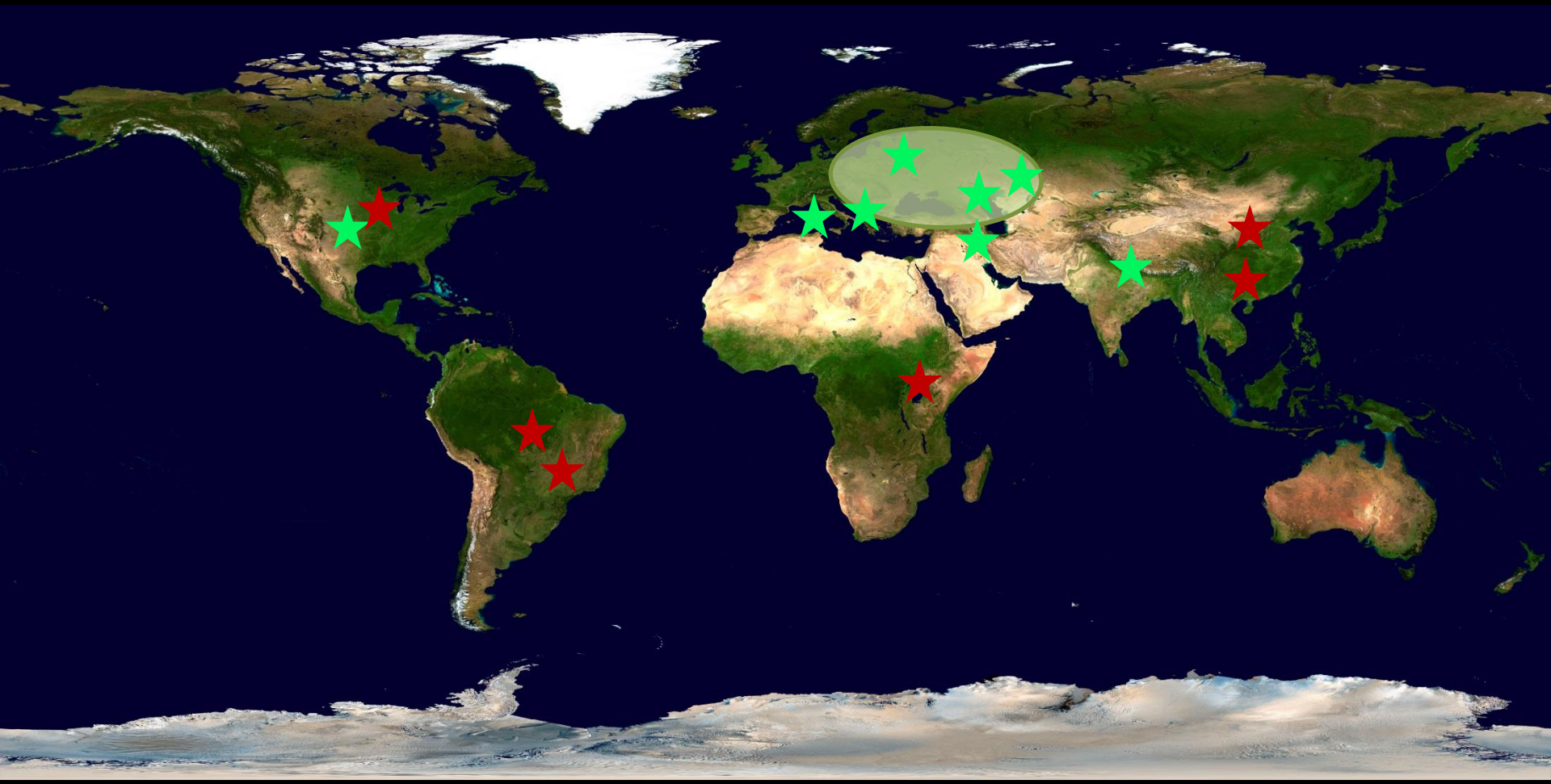
Results



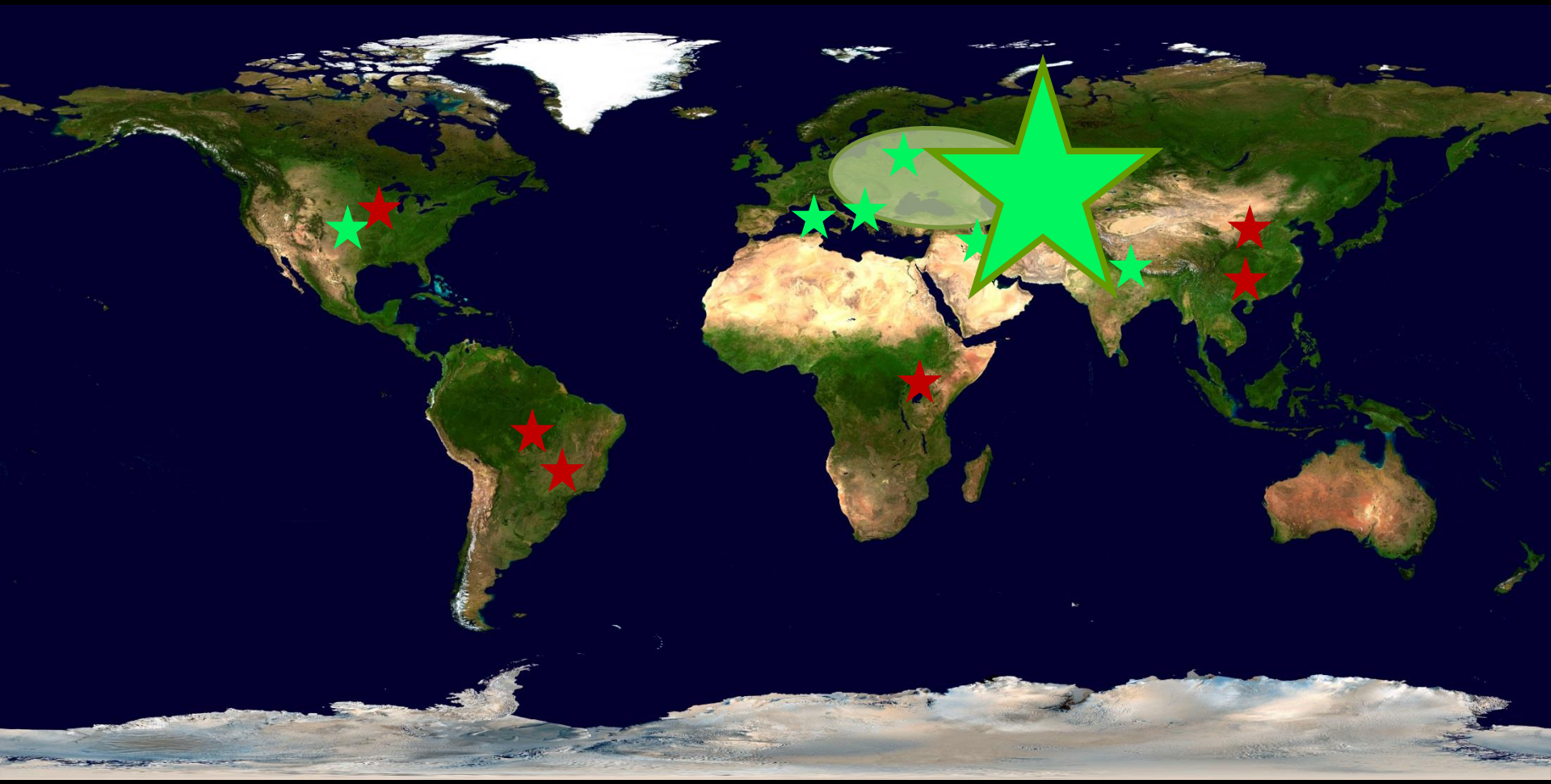
Results

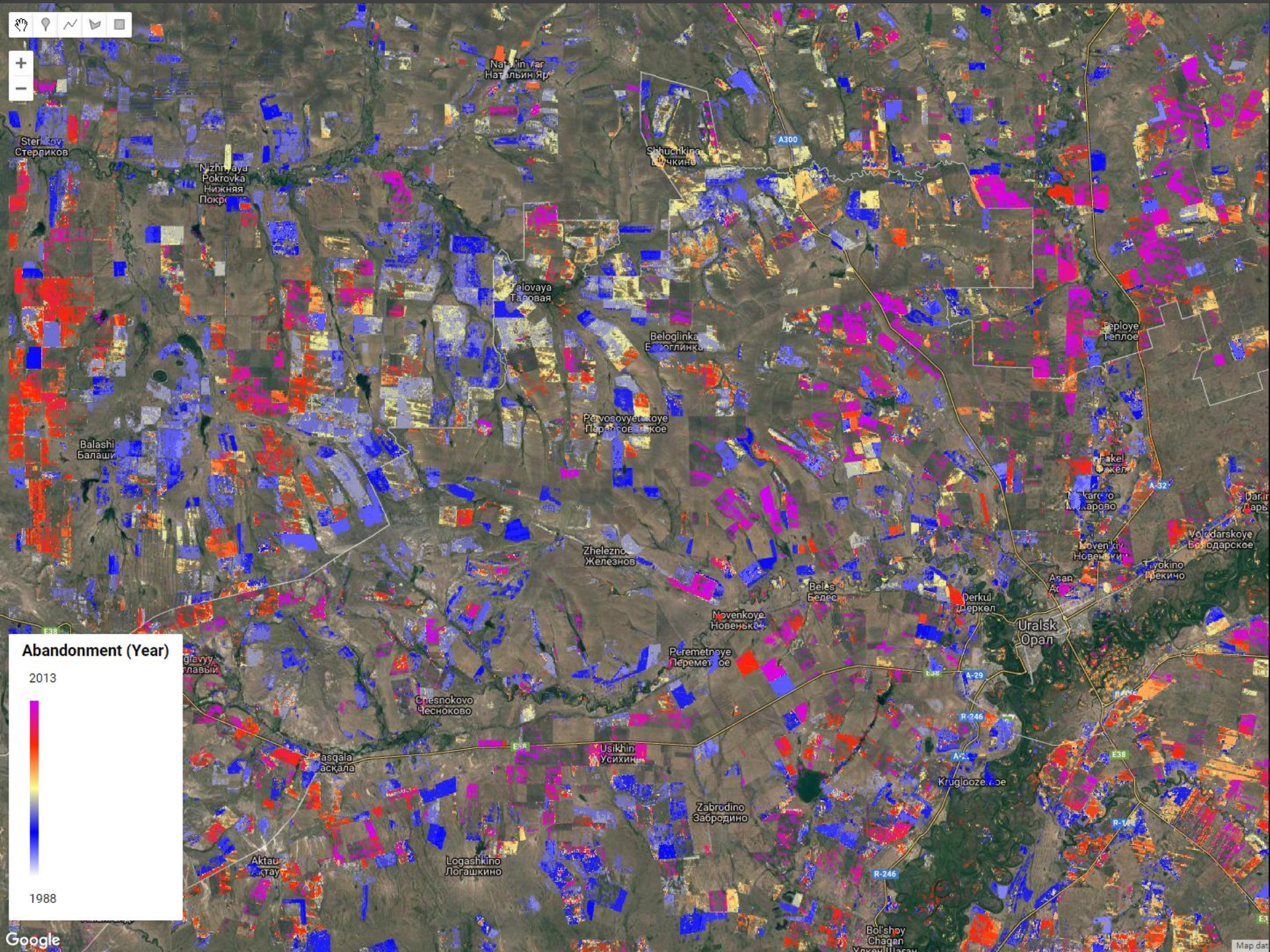
Where	Biome	Major cause
Smolensk, Russia	Temperate forests	Socio-economics
Orenburg, Russia	Semi-arid	Socio-economics
Volgograd, Russia	Grasslands	Socio-economics
USA, Nebraska	Grasslands	Economics
USA, Wisconsin	Temperate forests	Economics
Brazil, Amazon	Tropics Rainforest	Economics
Brazil, Cerrado	Tropics Dry Forest	Economics
Sardinia, Italy	Mediterranean	Socio-economics
Iraq	Semi-arid	Armed Conflict
S-China	Subtropical	Economics
N-China	Temperate	Political
Nepal	Mountainous	Social
Uganda	Tropical	Armed Conflict
Bosnia	Temperate	Armed Conflict

Results

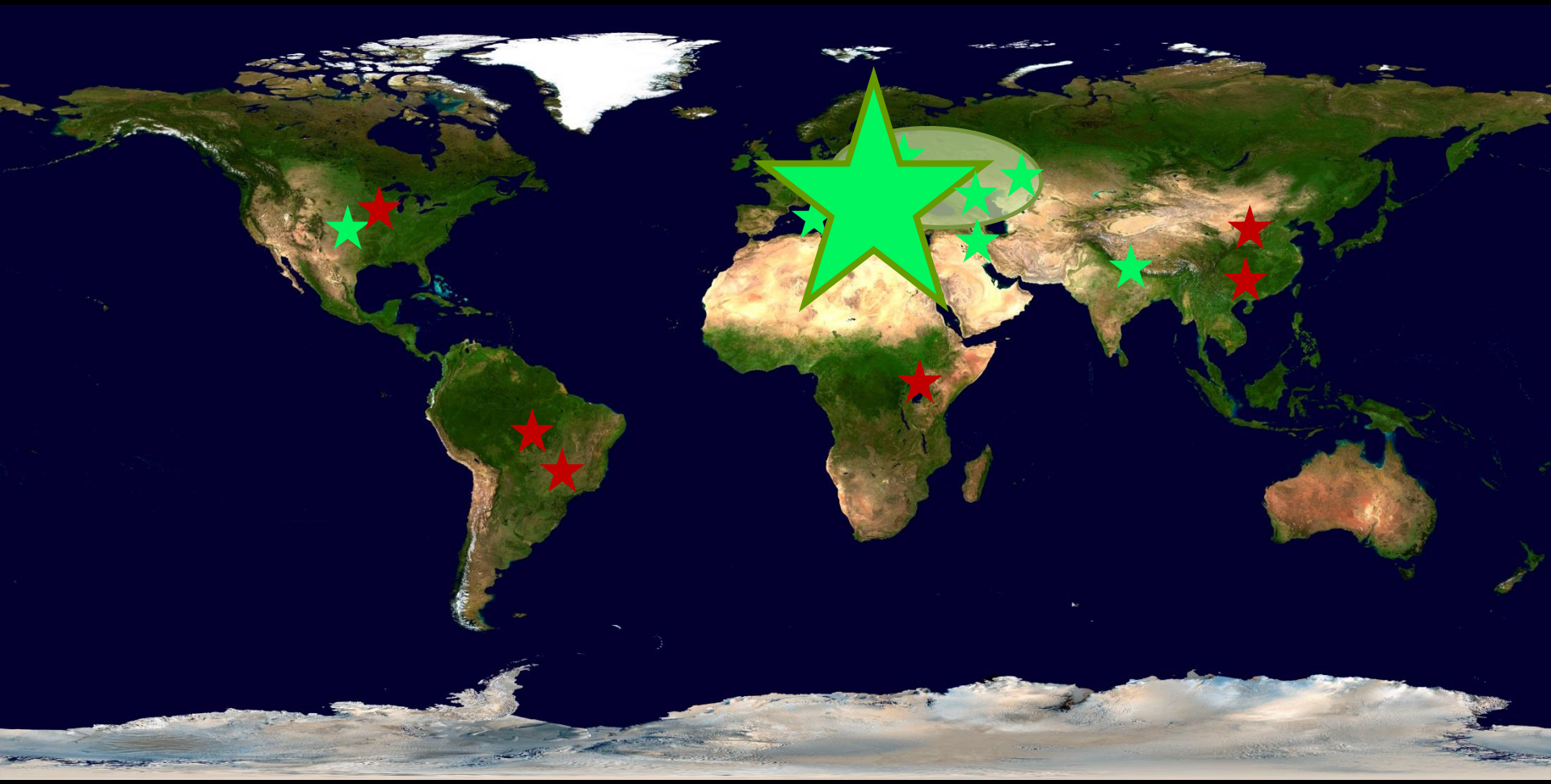


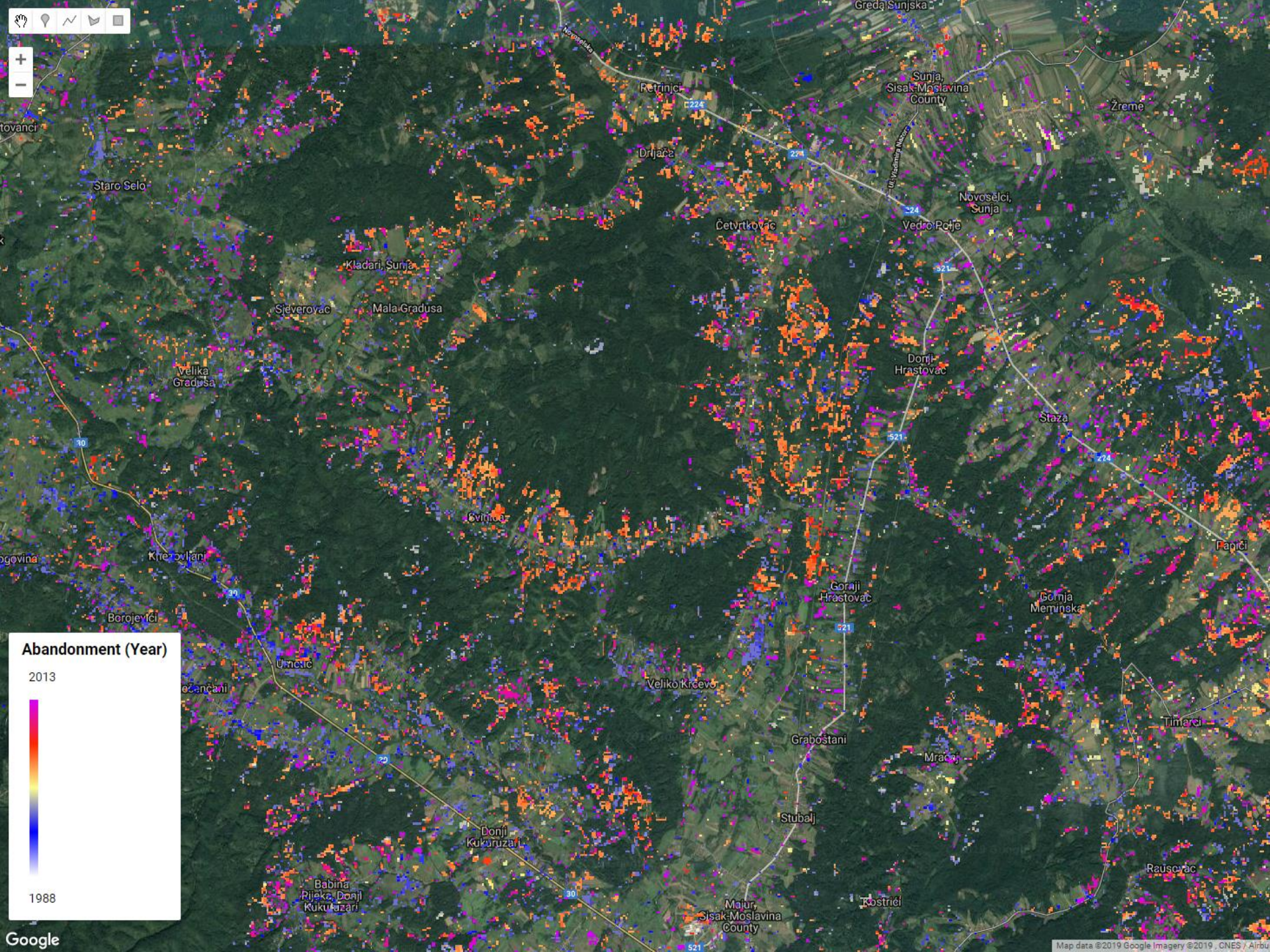
Orenburg, Russia



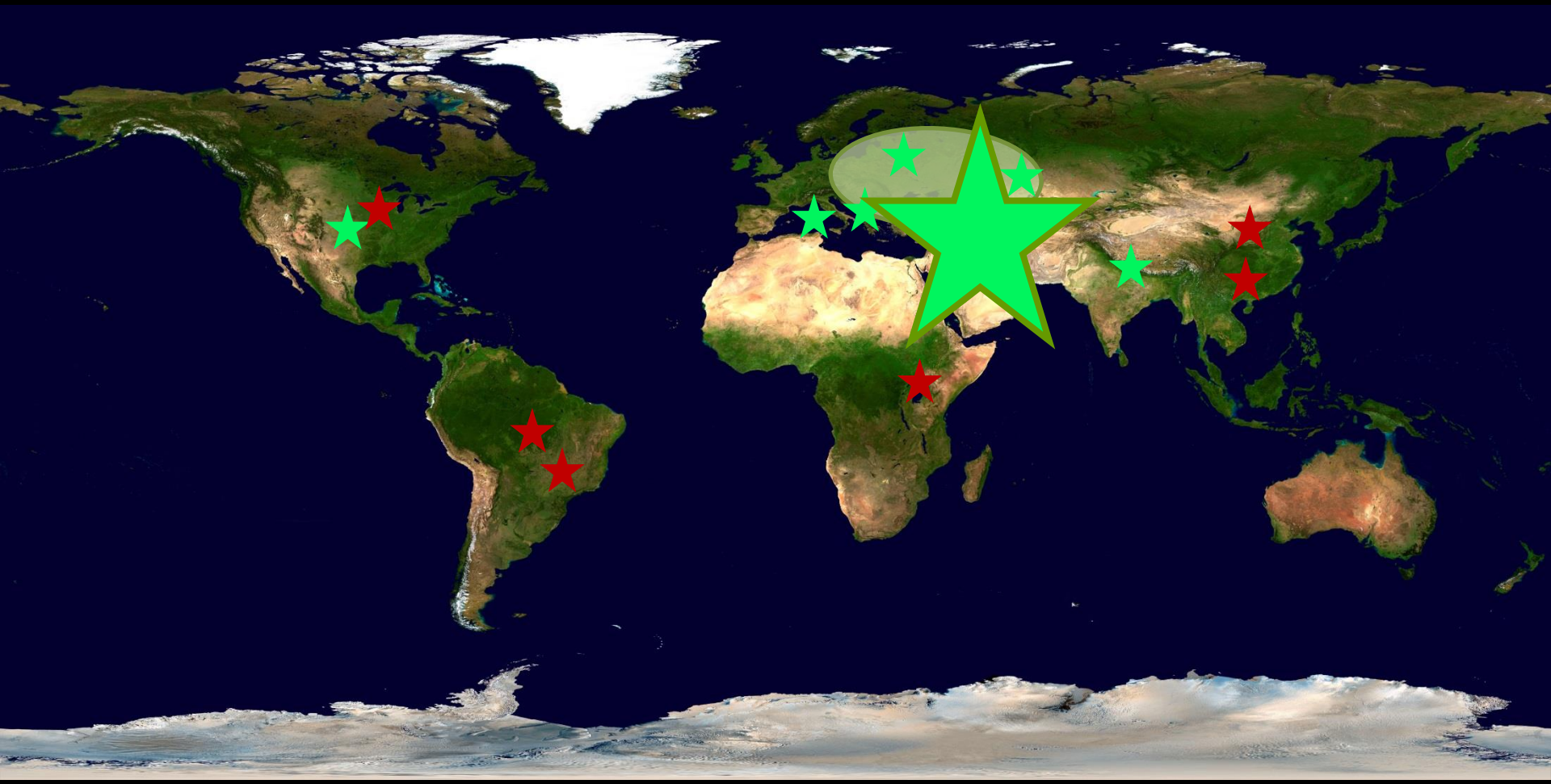

Abandonment (Year)
2013
1988
Uralsk
Орал
Pervosovetskoye
Первосоветское
Zheleznovo
Железнов
Chesnokovo
Чесноково
Usikhino
Усихино
Zabrodino
Забродино
Logashkino
Логашкино
Aktau
Актау
Novenkoye
Новенькое
Peremetnoye
Переметное
Derkul
Деркул
Tryokino
Трекино
Volodarskoye
Володарское
Nizhnyaya Pokrovka
Нижняя Покр
Shchuchkino
Щучкино
Teplovaya
Тепловая
Beloglinka
Белоглинка
Teploye
Теплое
Balashi
Балаши
Sterlikov
Стерликов
Natalin Yar
Натальин Яр
A300
A-32
A-29
R-246
E38
Google

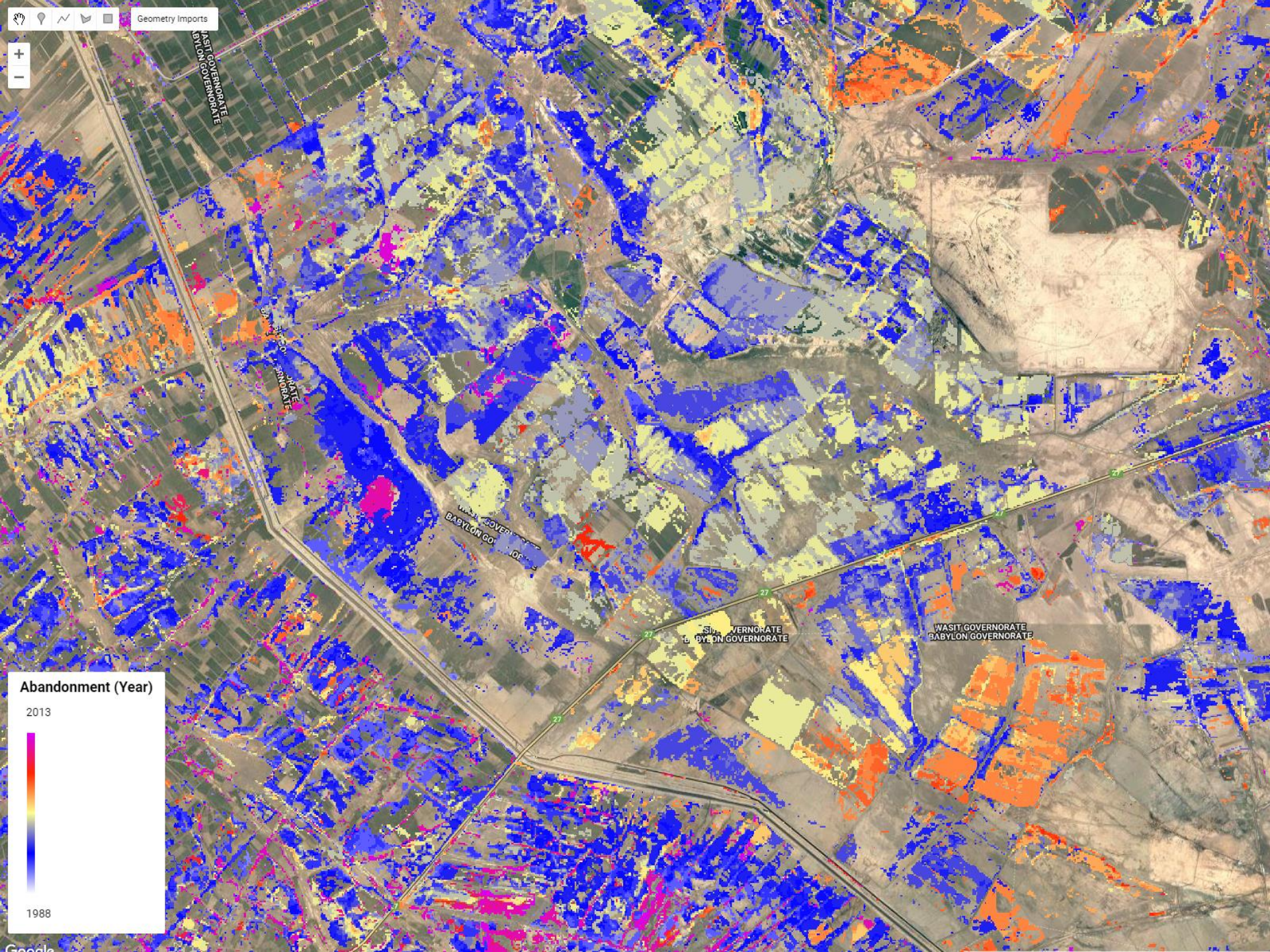
Bosnia



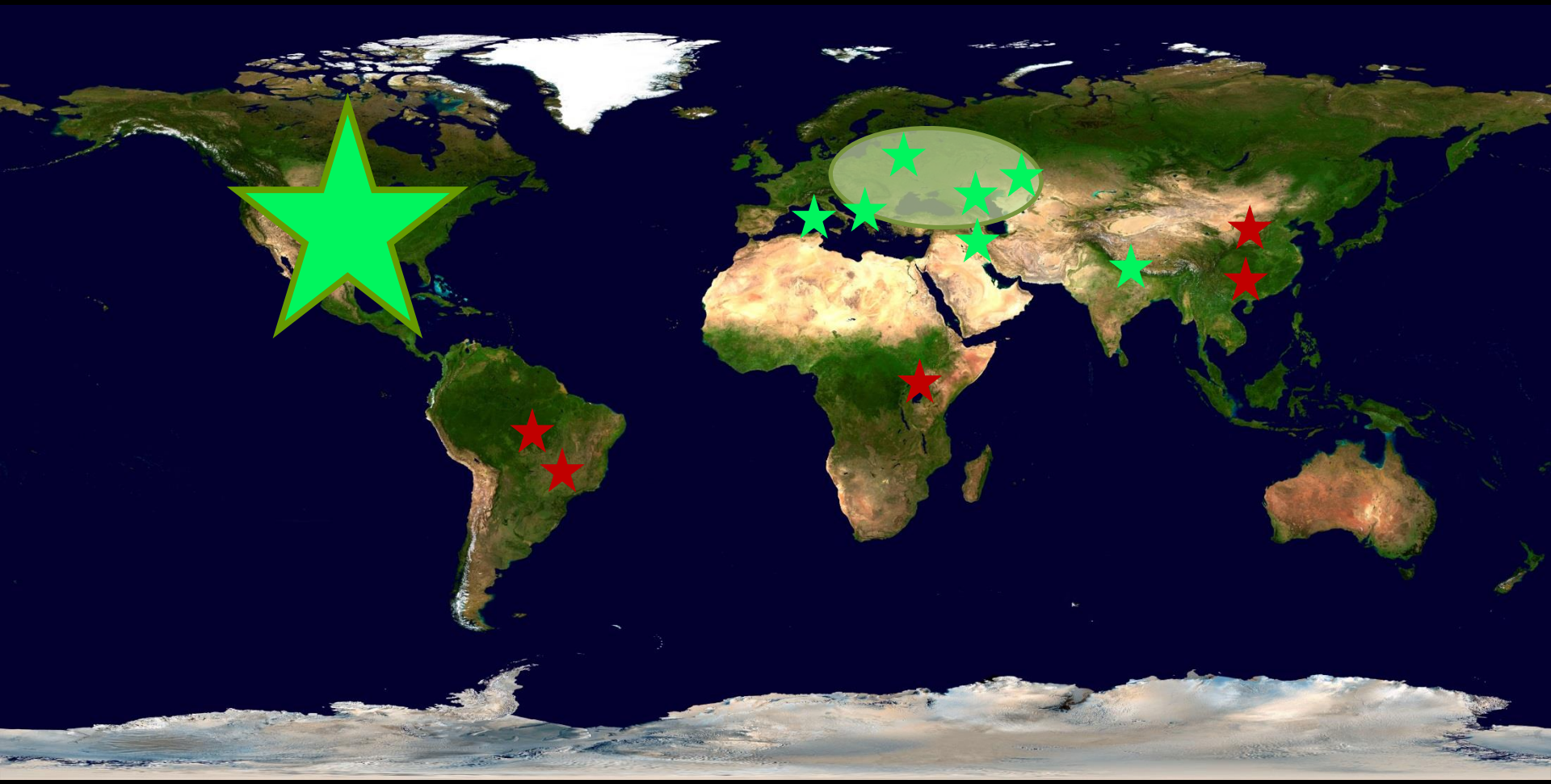

Abandonment (Year)
2013
1988
Gredа Sunjska
Sunja, Sisak-Moslavina County
Žreme
Retinjci
Drljača
Staro Selo
Novoselci, Sunja
Vedro Polje
Četvrtkovac
Kladari, Sunja
Sjeverovac
Mala Gradusa
Velika Gradusa
Donji Hrastovac
Staza
Papići
Gornji Hrastovac
Gornja Memeška
Borojevići
Veliko Krčevo
Graboštani
Mraclin
Timarci
Stubalj
Donji Kukuruzari
Babina Pijeka, Donji Kukuruzari
Majur, Sisak-Moslavina County
Kostrići
Rausovac
Google
Map data ©2019 Google Imagery ©2019 , CNES / Airbu

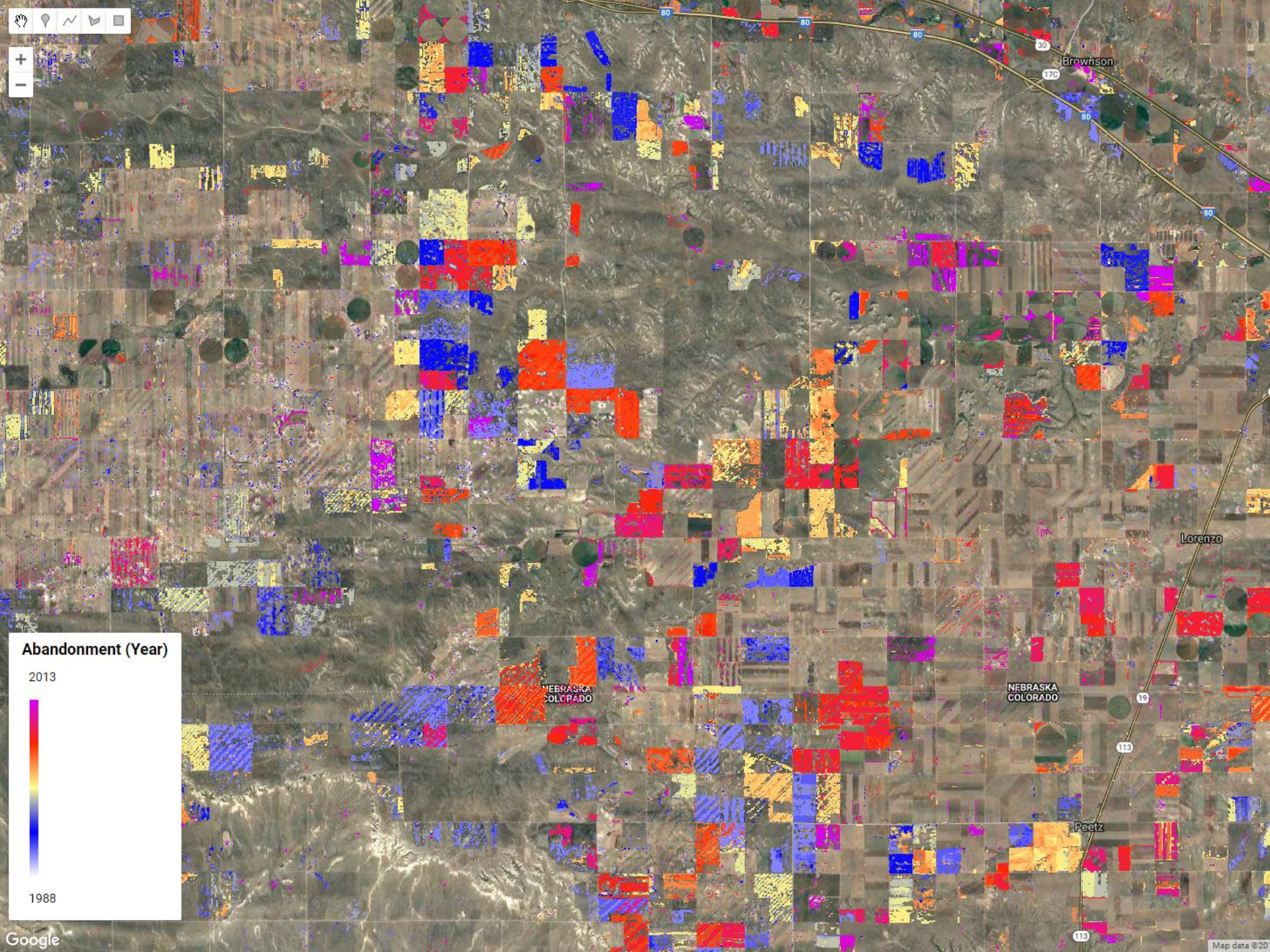
Iraq



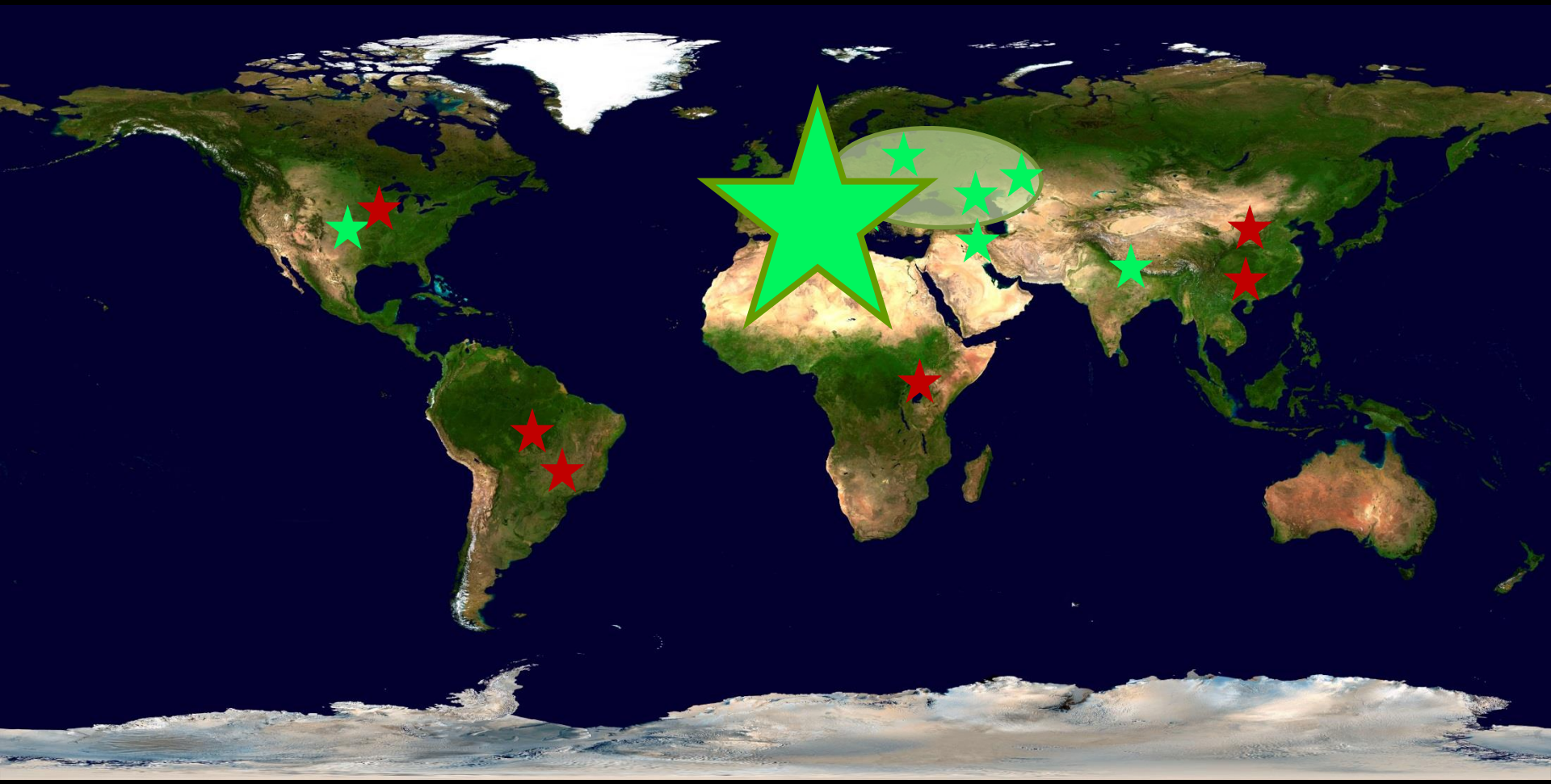

Geometry Imports
Abandonment (Year)
2013
1988
WASIT GOVERNORATE
BABYLON GOVERNORATE

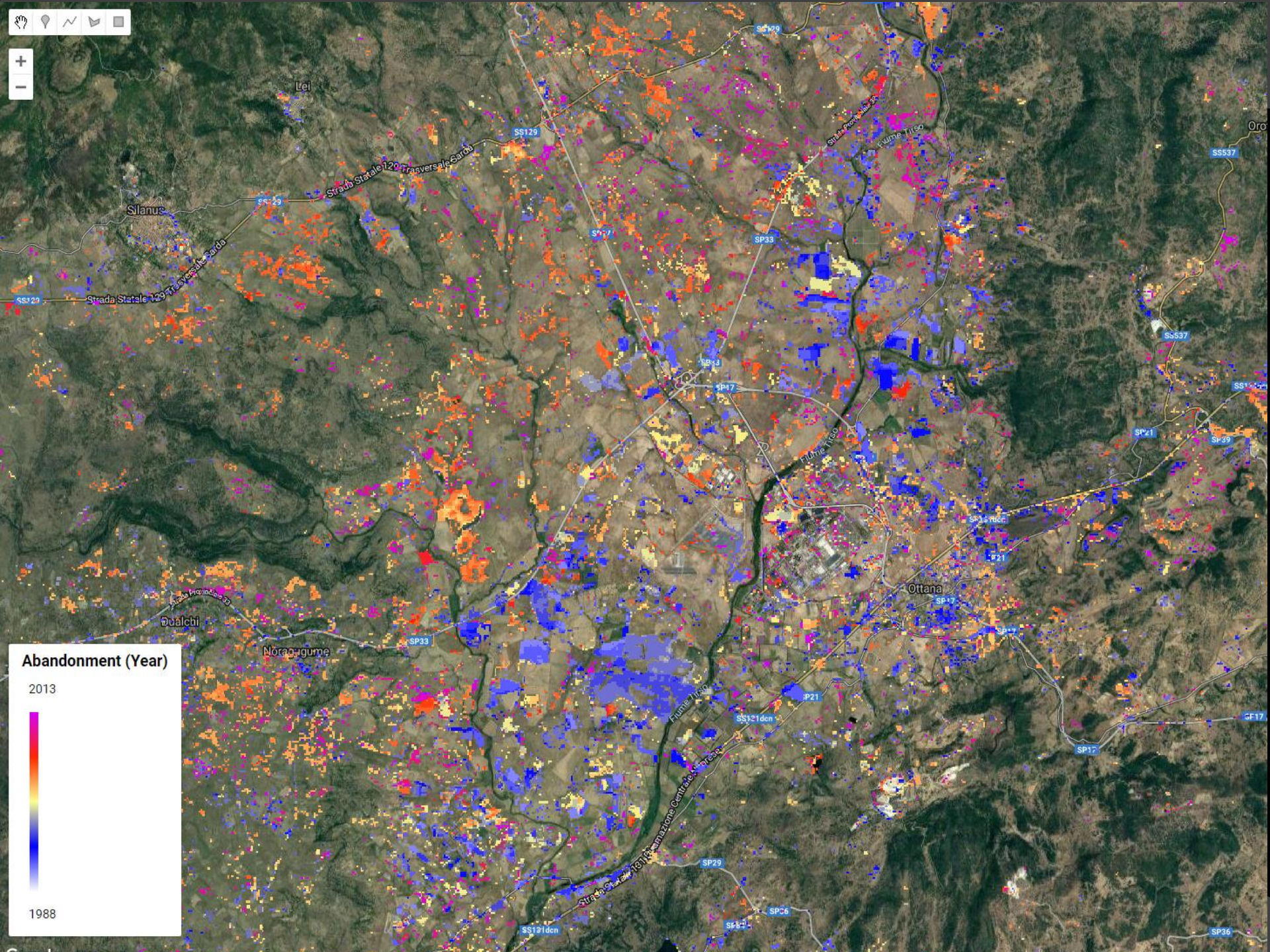
Nebraska, USA



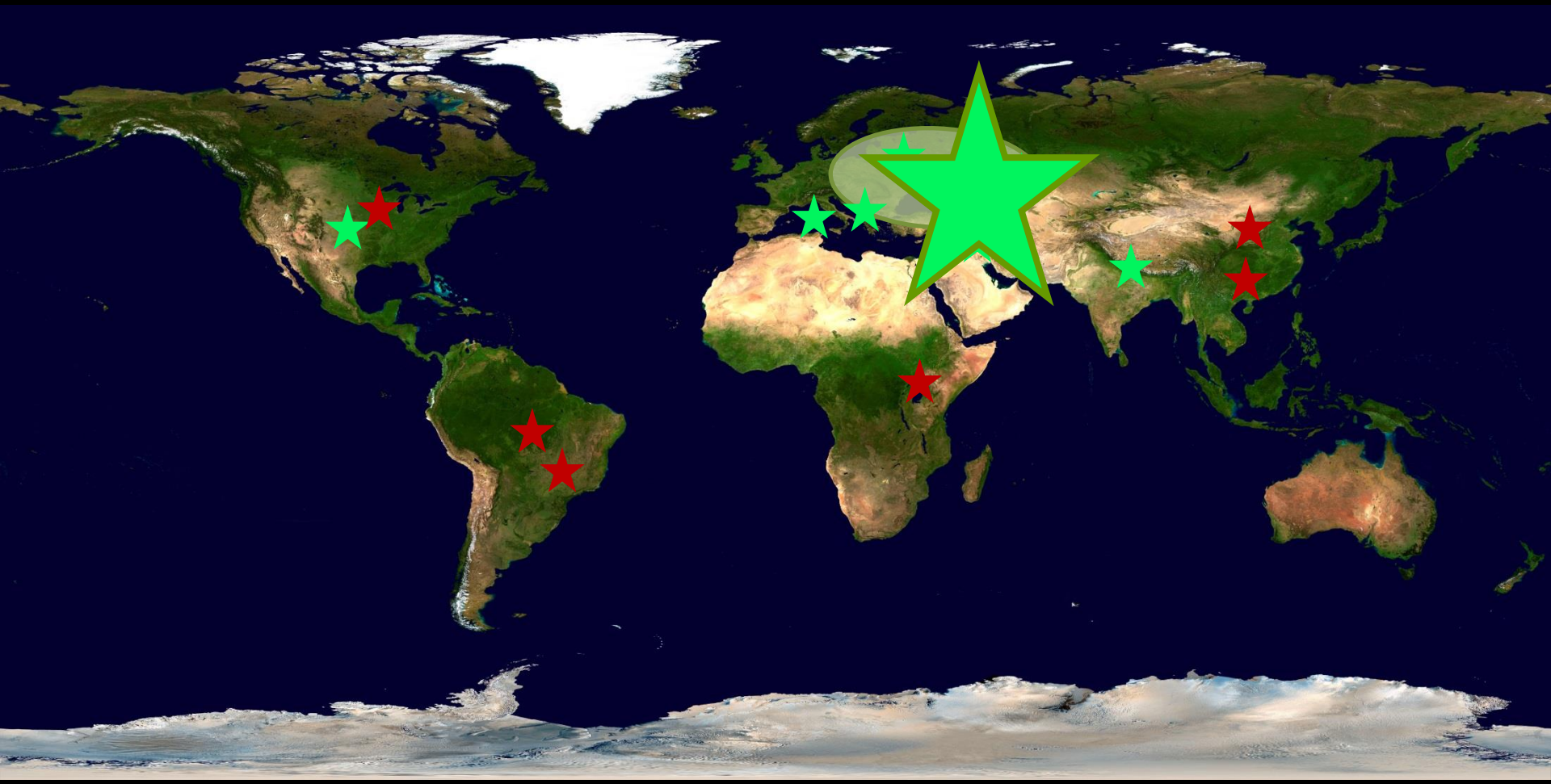

Abandonment (Year)
2013
1988
Brownson
Lorenzo
Peetz
NEBRASKA
COLORADO
NEBRASKA
COLORADO
80
30
170
19
113
Google
Map data ©20

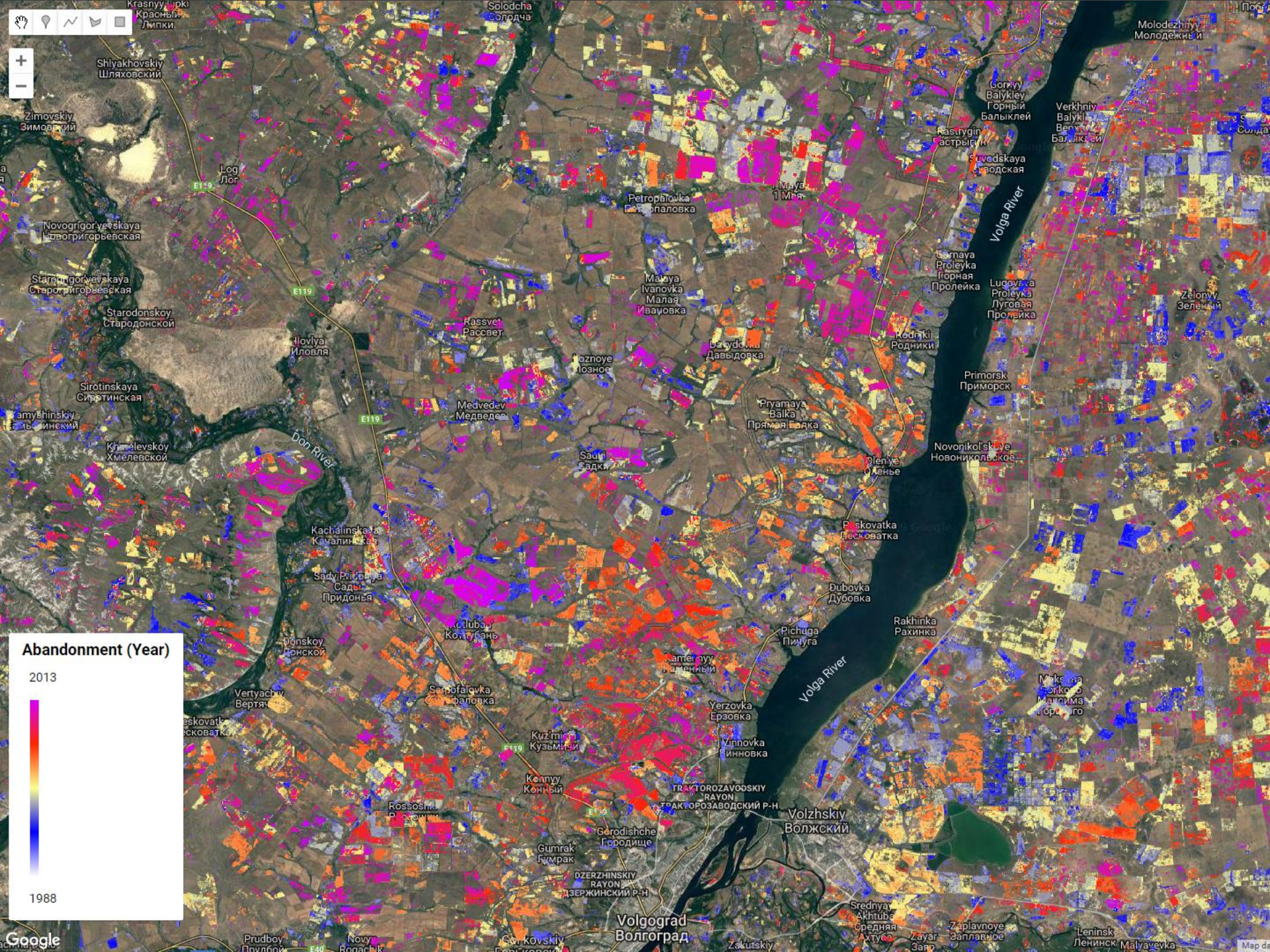
Sardinia, Italy



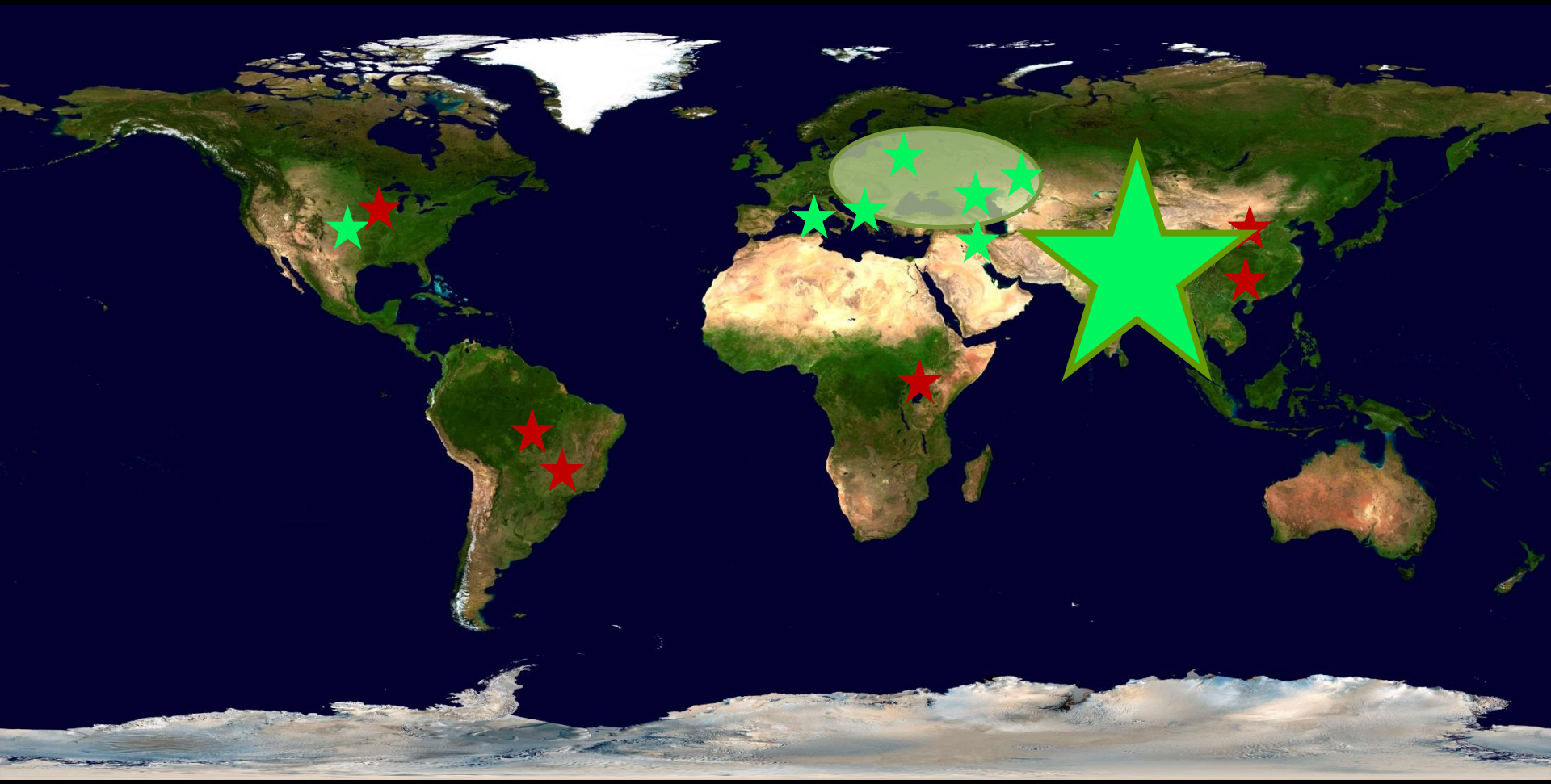

Abandonment (Year)
2013
1988
Lei
Silanus
Dualchi
Noragugume
Ottana
Fiume Tirso
Strada Statale 129 Trasversale Sarda
SS129
SP33
SP17
SP21
SS537
SP29
SS131dcn

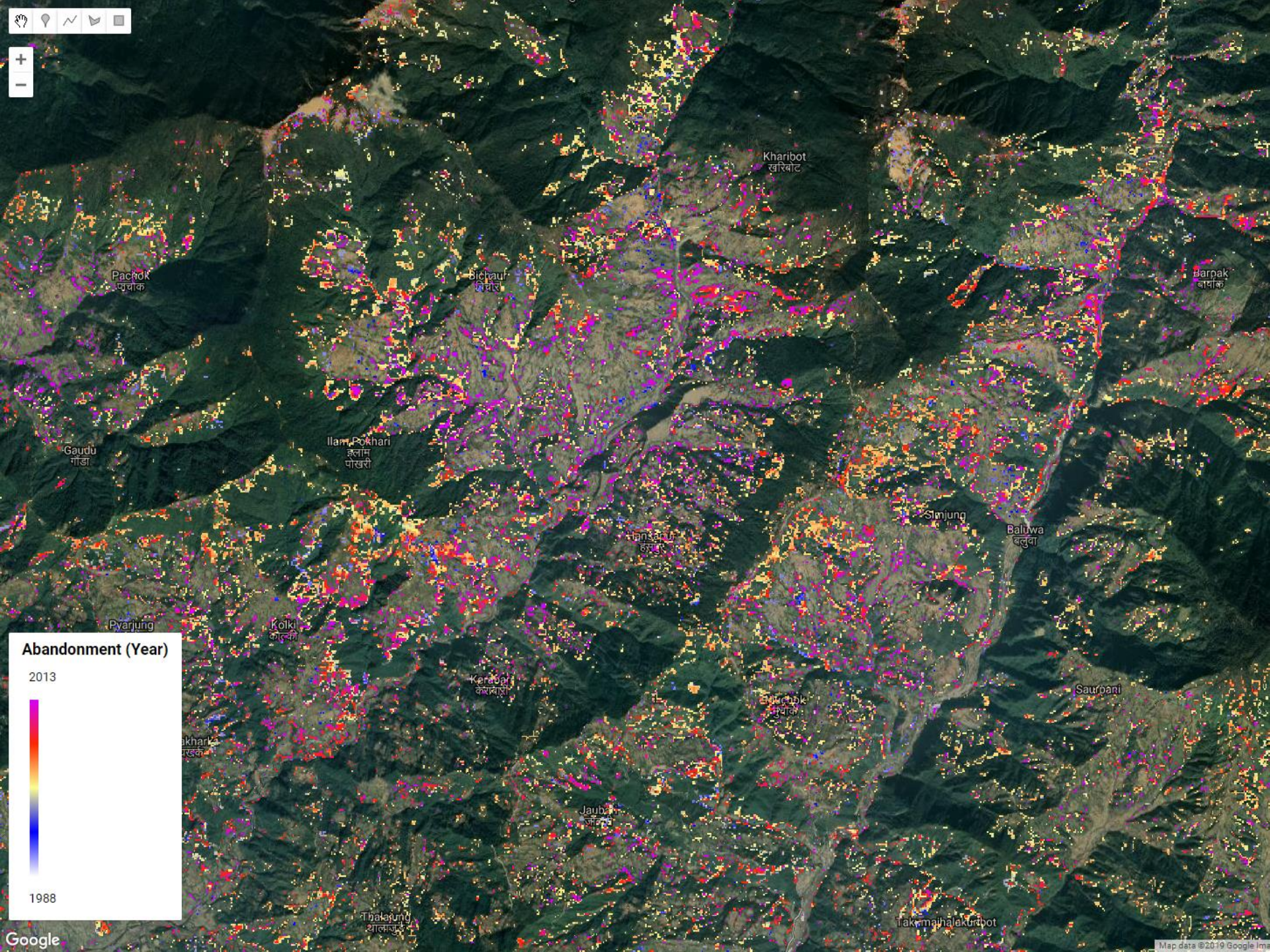
Volgograd, Russia



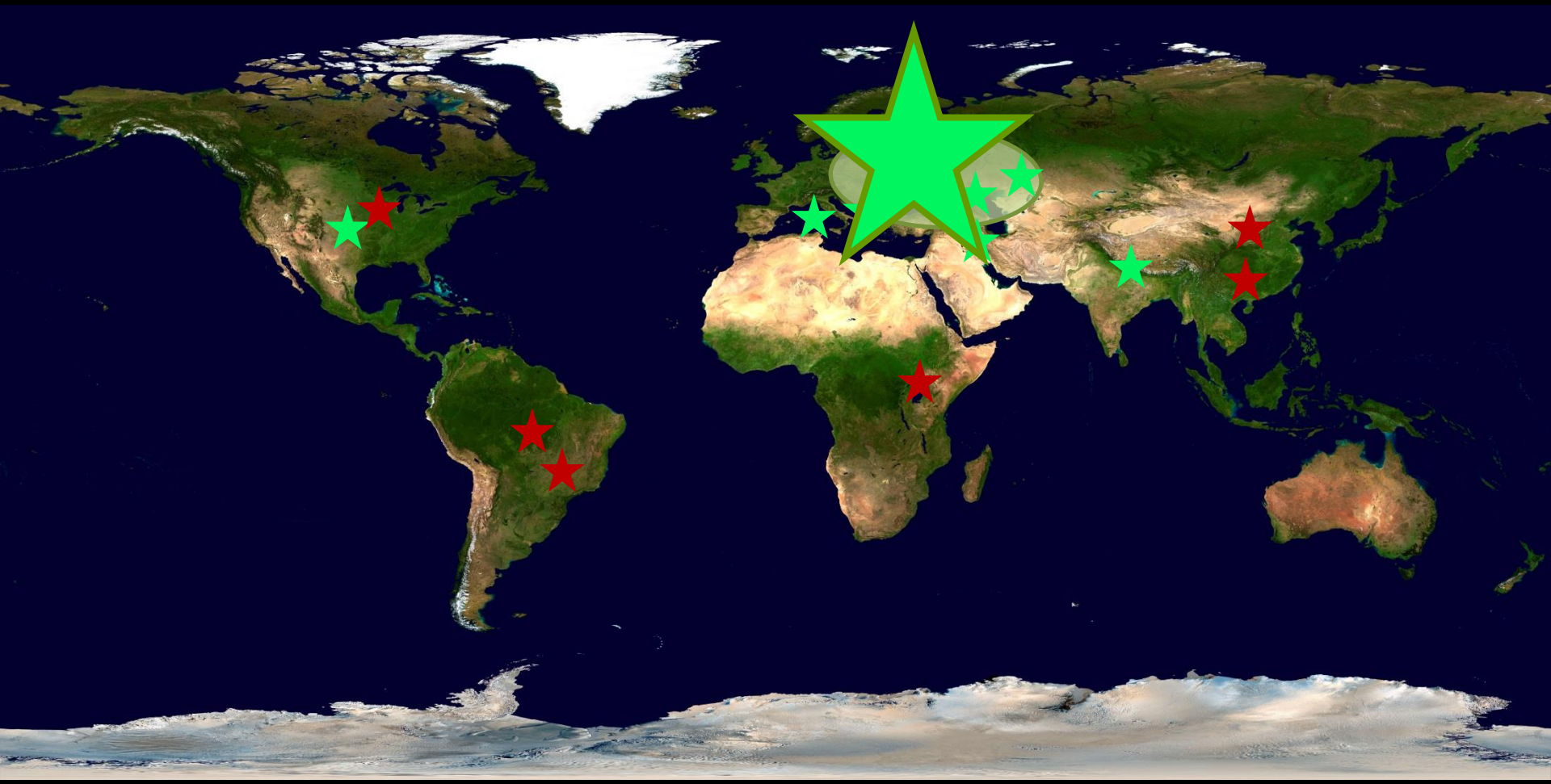

Abandonment (Year)
2013
1988
Volga River
Don River
Volgograd
Волгоград
Volzhskiy
Волжский
Google

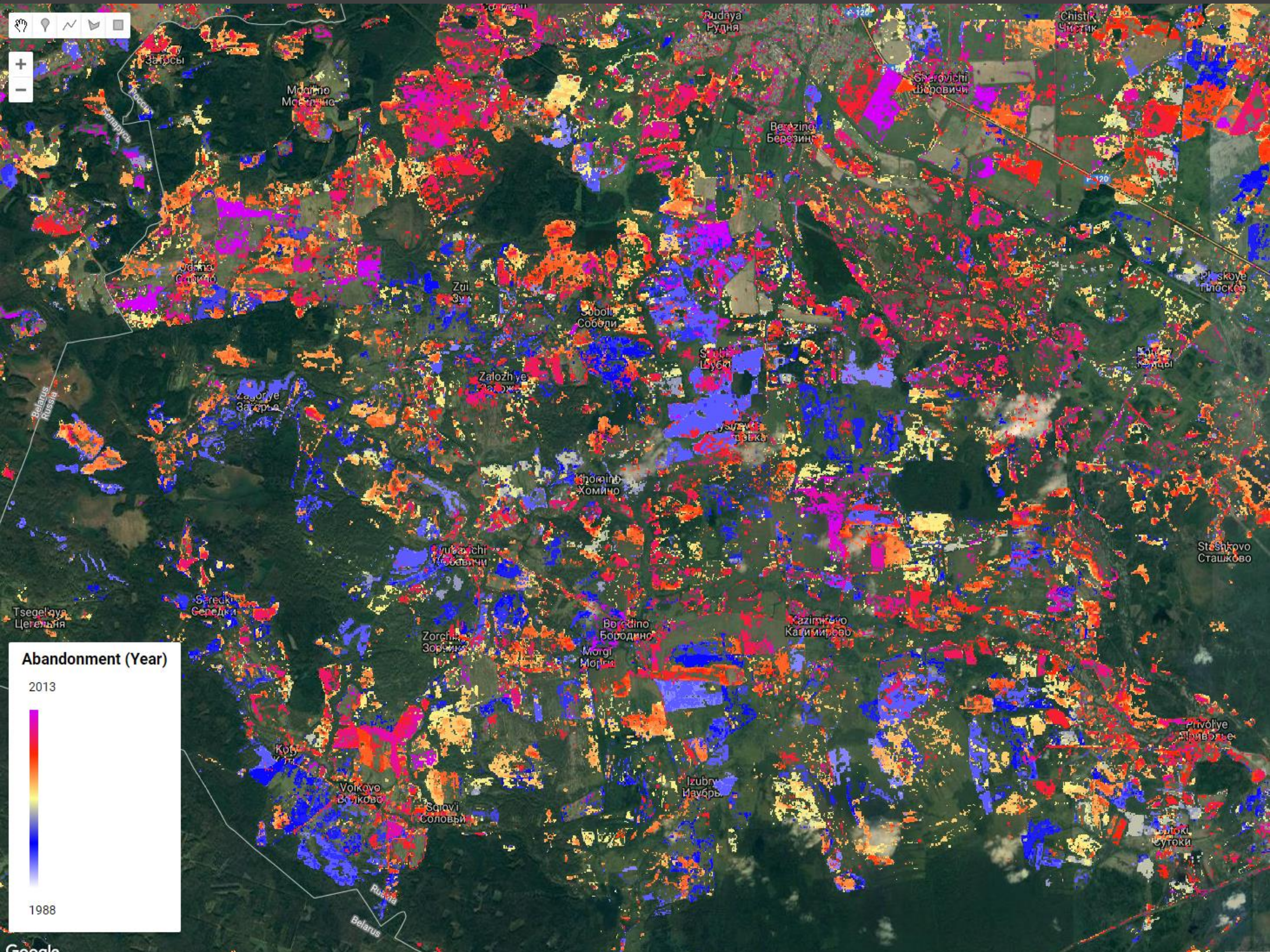
Nepal




Abandonment (Year)
2013
1988
Kharibot
खरिबोट
Pachok
पचोक
Bichauf
बिचौर
Barpak
बारपाक
Gaudu
गाँडा
Ilam Pokhari
इलाम पोखरी
Simjung
Baluwa
बलुवा
Pyarjung
Kolki
कोल्की
Saurpani
Jaubari
जौबारी
Thalajung
थालाजुङ
Google
Map data ©2019 Google Ima

Smolensk, Russia





Abandonment (Year)
2013
1988
Rudnya
Рудня
Chistik
Чистик
Shchorovichi
Щоровичи
Berezino
Березино
Zui
Зуи
Soboli
Соболи
Zalozhye
Заложье
Zagorye
Загорье
Khomino
Хомино
Borodino
Бородино
Kazimirovo
Казимирово
Staskovo
Сташково
Privolye
Привольє
Izubry
Изубры
Solovi
Соловьи
Volkovo
Волково
Sredki
Середки
Tsegelnya
Цегельня
Sutoki
Сутоки
Russia
Belarus
Google

Results

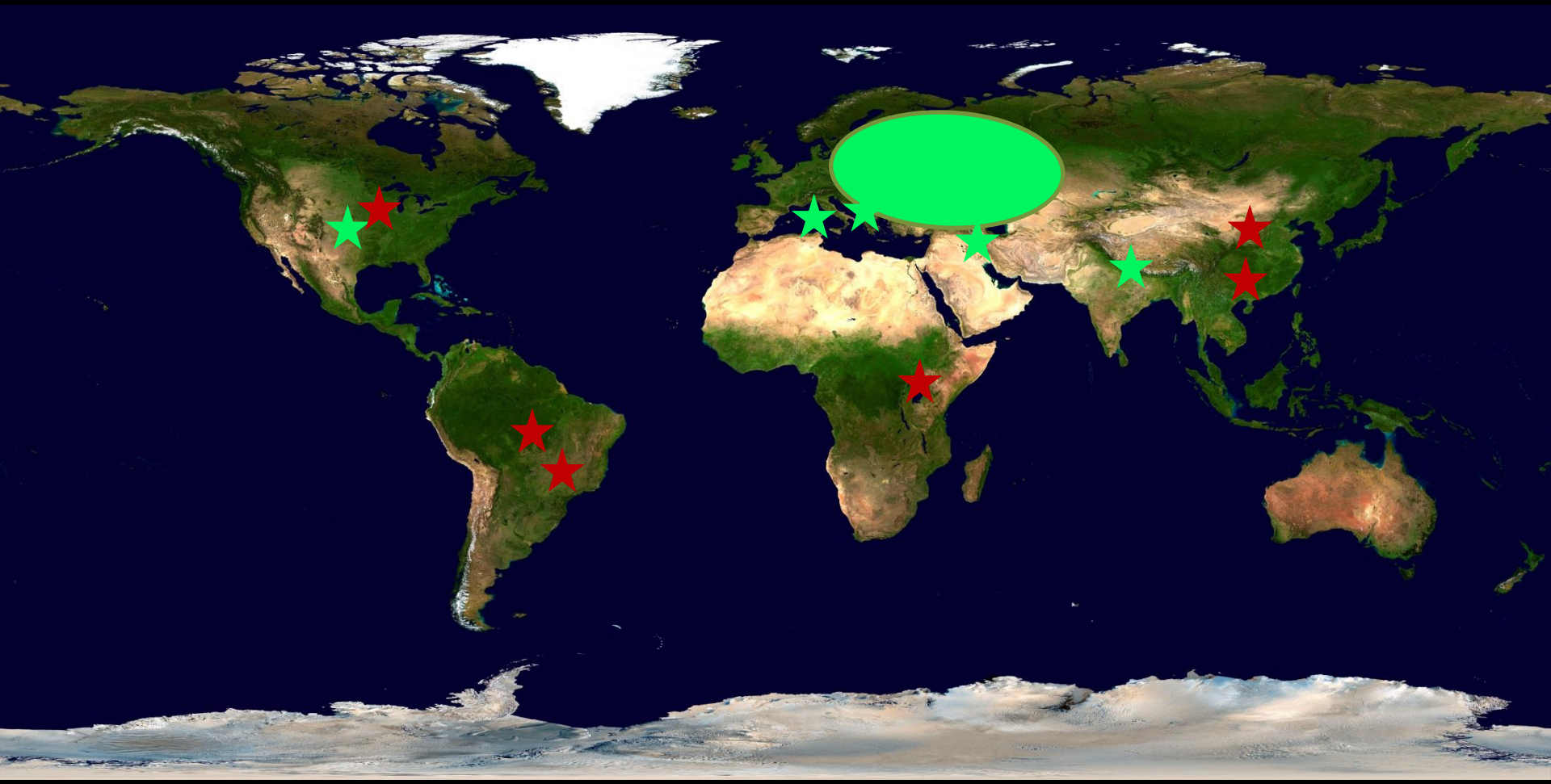
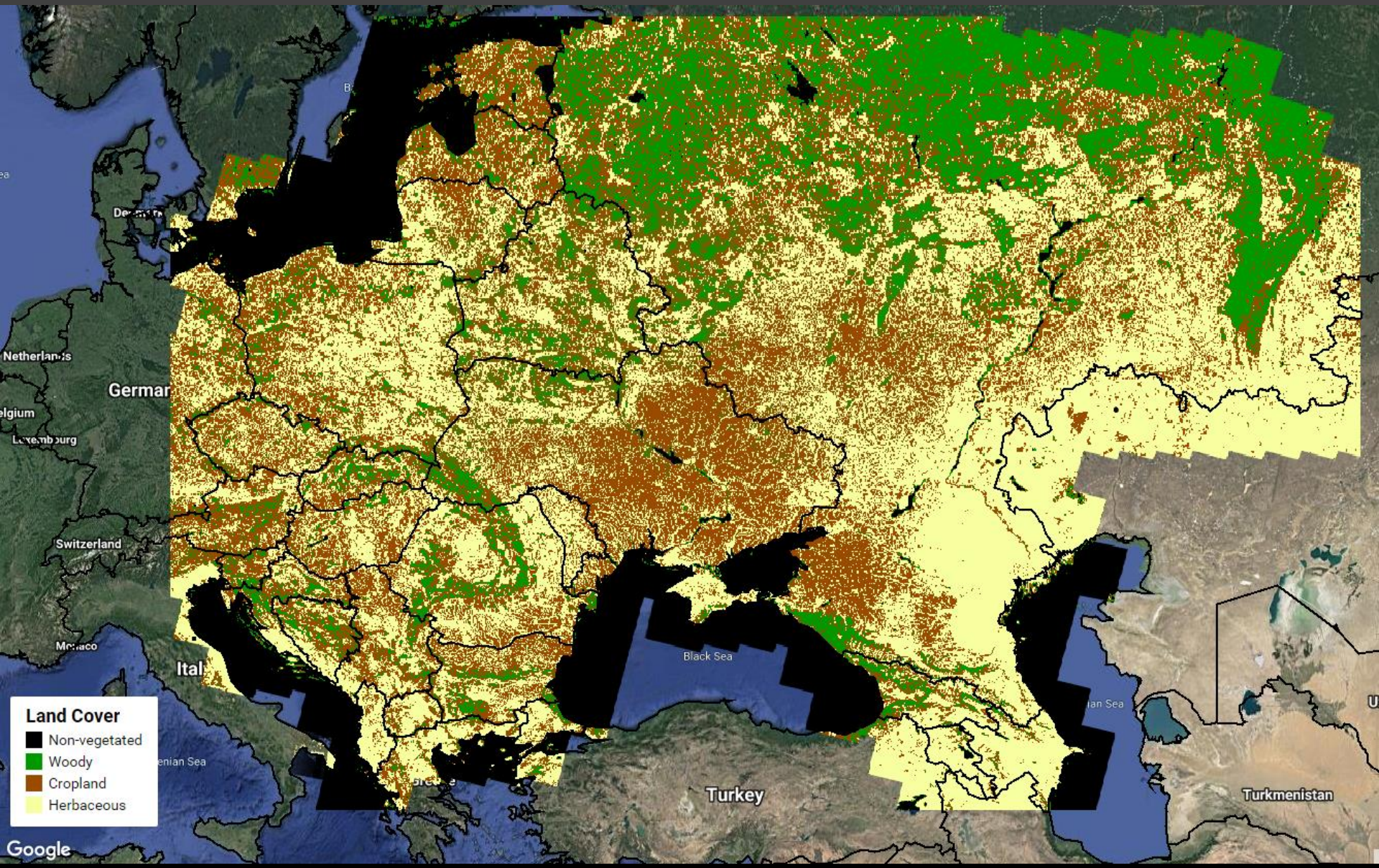
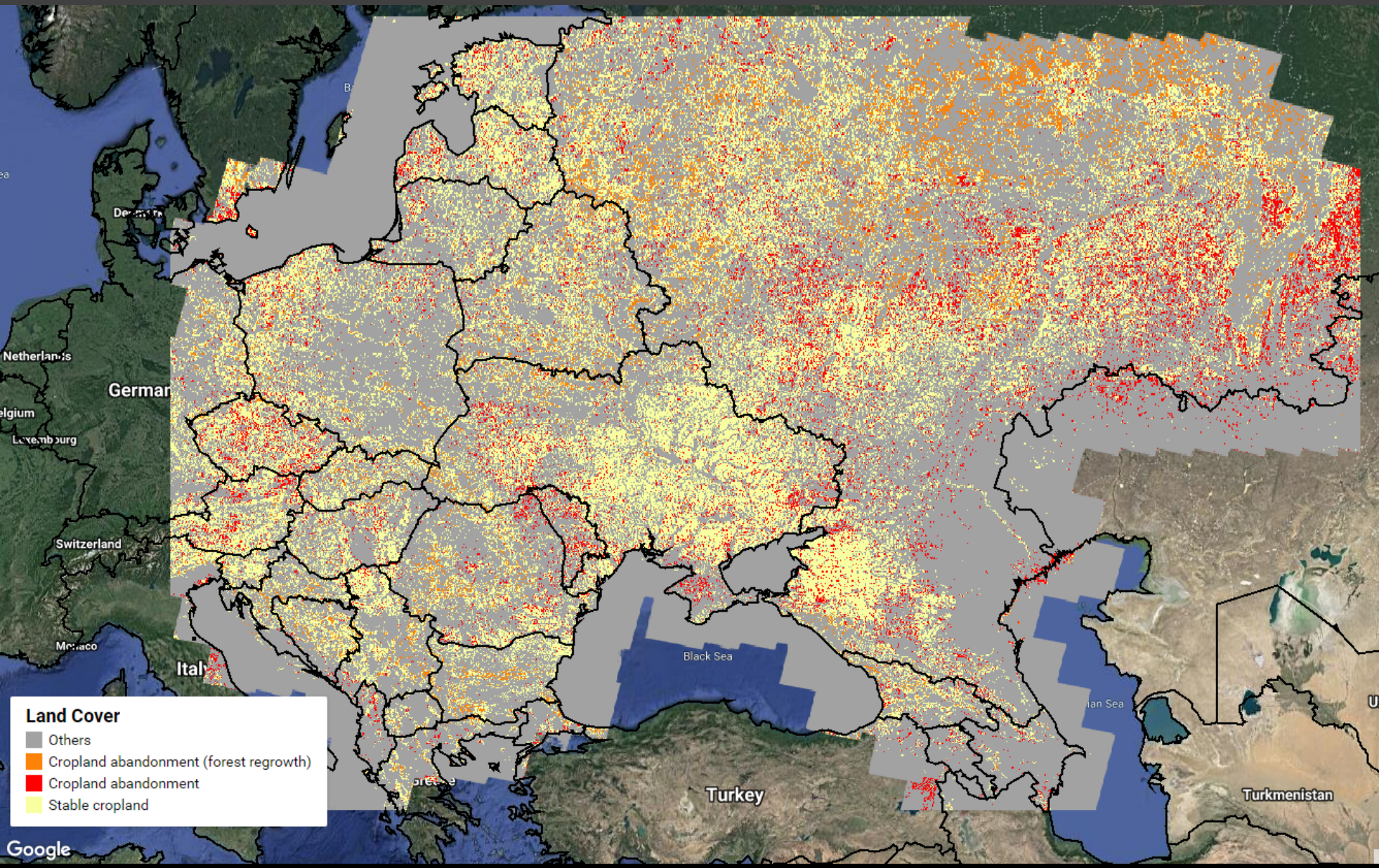


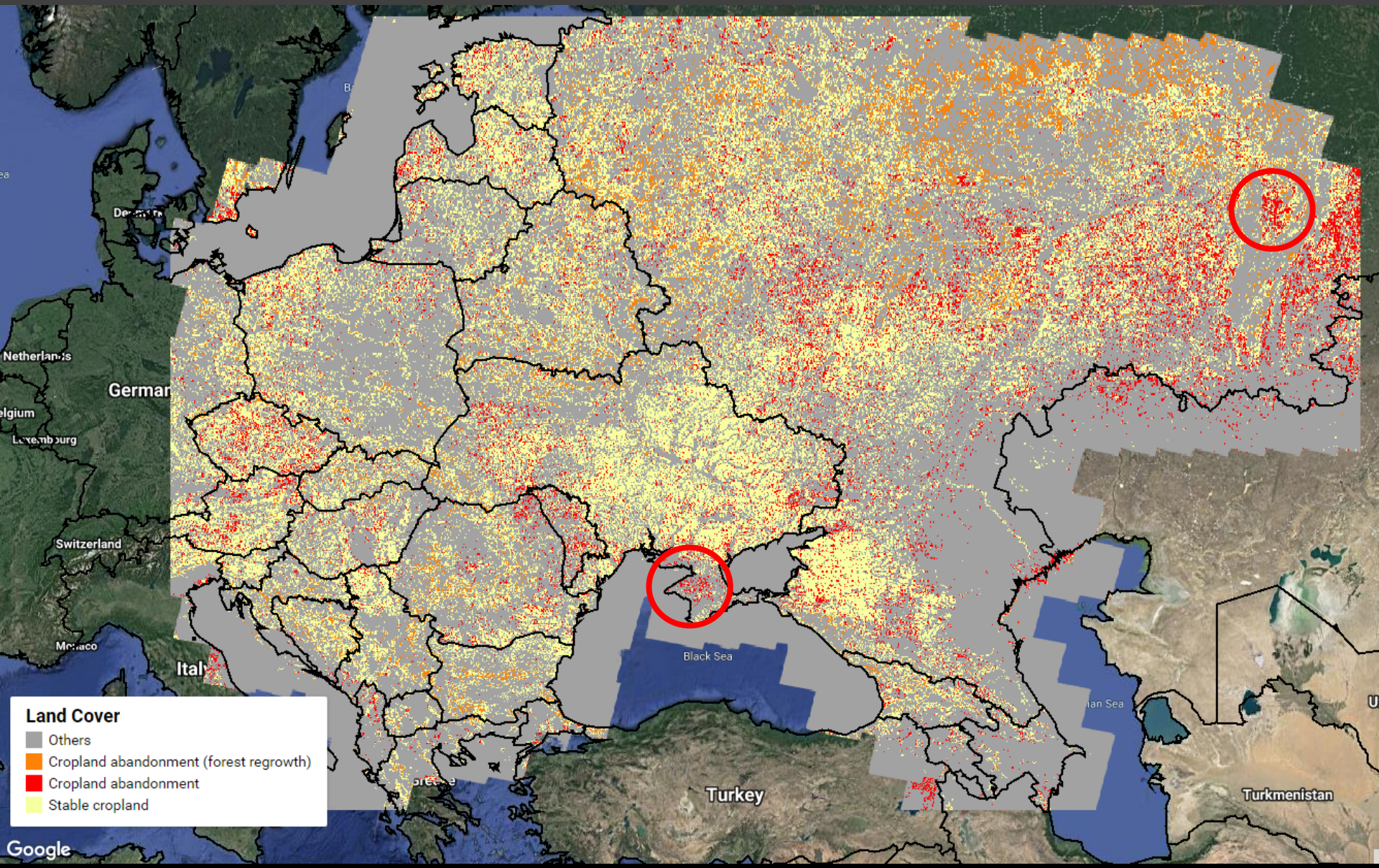
Image composite (RGB: 743) in 1987

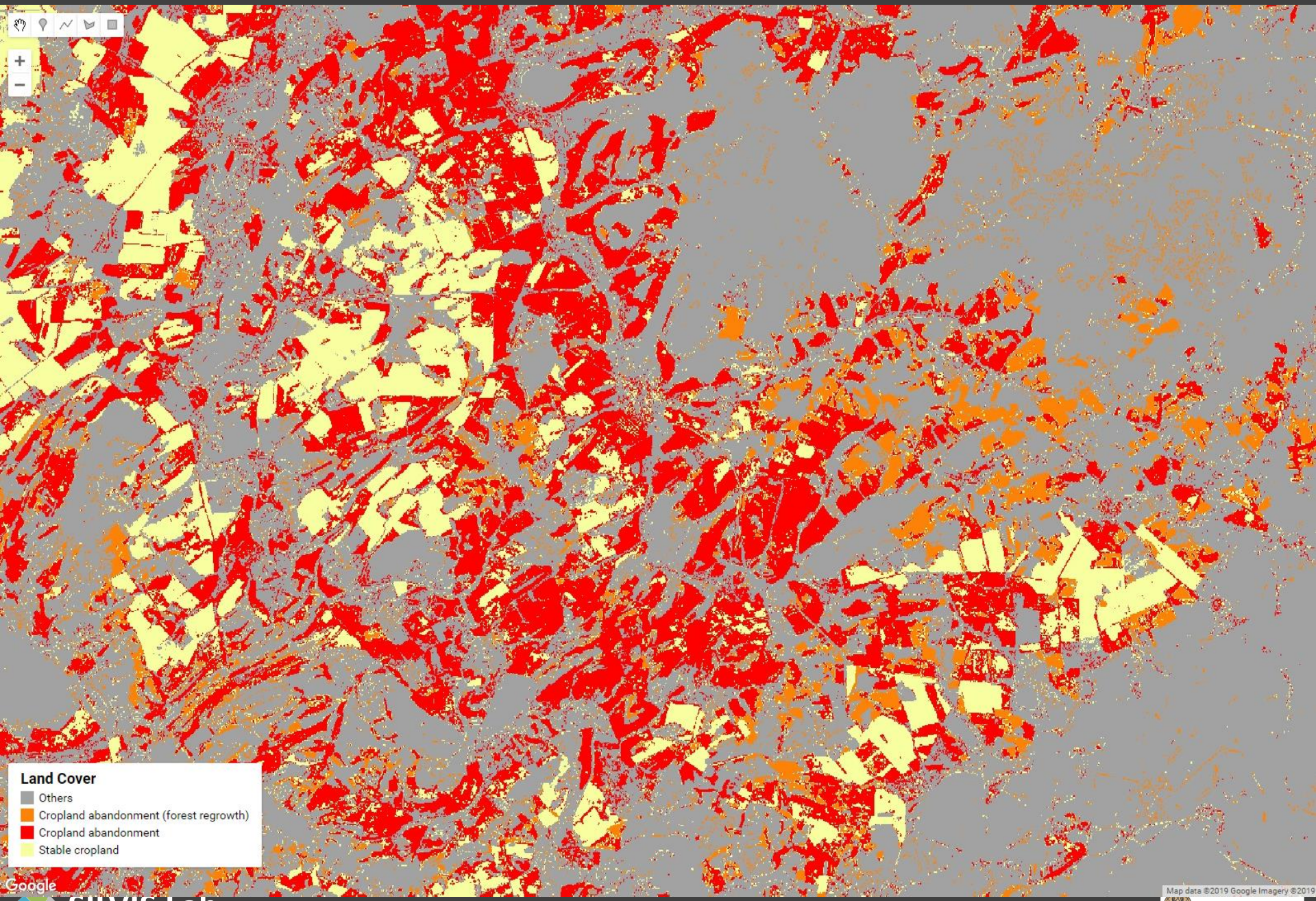


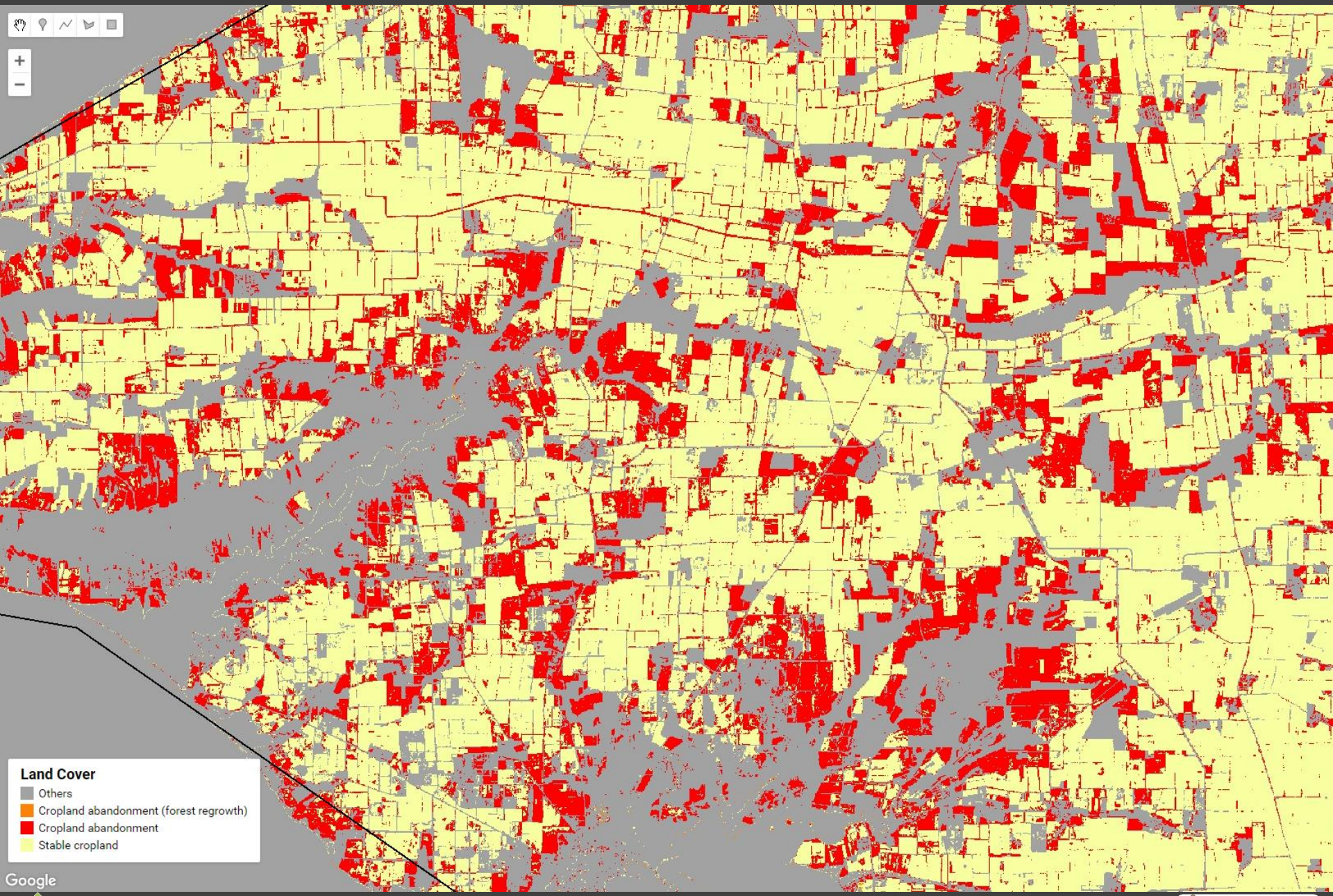
Land cover map in 1987



Cropland abandonment (1987-2017)


Land Cover
Others
Cropland abandonment (forest regrowth)
Cropland abandonment
Stable cropland
Black Sea
Turkey
Turkmenistan
Switzerland
Google


Land Cover
Others
Cropland abandonment (forest regrowth)
Cropland abandonment
Stable cropland
Google
Map data ©2019 Google Imagery ©2019


Land Cover
Others
Cropland abandonment (forest regrowth)
Cropland abandonment
Stable cropland
Google

Conclusions

- What is novel
  - Annual maps of abandonment: abandonment is frequent

Conclusions

- What is novel
  - Annual maps of abandonment: abandonment is frequent
  - Mapping algorithm that works globally: abandonment widespread across the globe

Conclusions

- What is novel
  - Annual maps of abandonment:
    abandonment is frequent
  - Mapping algorithm that works globally:
    abandonment widespread across the globe
  - Mapping algorithm that works in both forest and dryland biomes:
    abandonment widespread in drylands

Conclusions

- What is next
  - Annual maps of abandonment for E-Europe
  - Separating hayfield, pastures, and natural grasslands
  - Quantifying the value of having both Landsat and Sentinel-2

Conclusions

- In summary
  - Agricultural abandonment is an important LCLUC process

    But has been stepchild of land use science

  - We can map abandonment annually and in different biomes

    It is great to live the era of two Landsats and two Sentinel-2s

Thank you!