Exploring U.S. Cropland Using AgKit4EE Toolkit

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BACKGROUND

Google Earth Engine (GEE) is an ideal platform for large-scale geospatial agricultural and environmental modeling. However, using GEE to prepare agricultural land use data for geospatial agricultural and environment modeling requires not only the programming skills of GEE APIs but also the knowledge of the data. This paper presents a toolkit AgKit4EE to facilitate the use of the Cropland Data Layer (CDL) products over GEE platform. The toolkit contains a variety of frequently used functions for use of CDL products including crop sequence modeling, crop frequency modeling, confidence layer modeling, and land use change analysis, which can significantly reduce the workload for modelers who perform geospatial agricultural and environmental modeling with CDL data as well as developers who build the GEE-enabled cyberinfrastructure for agricultural land use modeling of the conterminous United States.

ARCHITECTURAL CONTEXT

The development of the AgKit4EE toolkit is fully based on GEE client library and GEE data catalog, which are powered by the high-performance computation and data stores of Google's cloud infrastructure. The core component of the toolkit is the AgKit4EE library, which contains a suite of modules such as modeling modules, statistics modules, and data processing modules. The library is developed using JavaScript, which is consistent with the GEE Code Editor. Users can directly import the library to any workspace of the GEE Code Editor or the GEE-enabled web applications. Currently, we have enabled AgKit4EE in two prototypes, the Cropland Explorer and the Crop Frequency Explorer, which are published over the Earth Engine Apps platform.
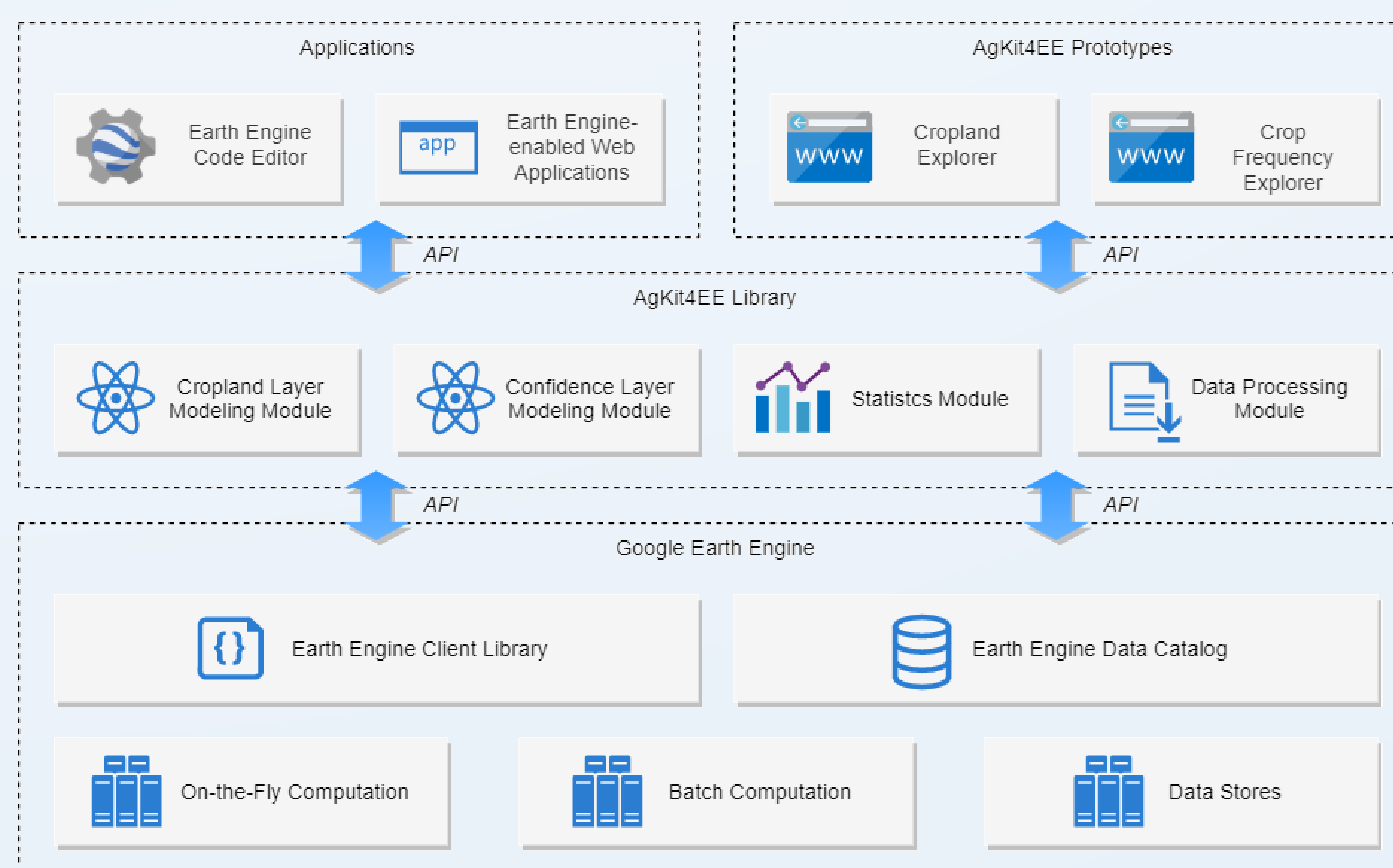
Architectural context of the proposed GEE-enabled toolkit for agricultural land use modeling

MAPS

The AgKit4EE toolkit offers a variety of frequently used agricultural land use modeling functions. Here we demonstrate the mapping result of crop sequence modeling and crop frequency modeling based on historical CDL data. The first map shows the spatial distribution of major crops that following the crop rotation across U.S. cropland. The second map shows the crop frequency of corn and soybeans over the State of Nebraska. Meanwhile, we have implemented two web application prototypes as Earth Engine Apps. These applications directly call the geospatial functions from AgKit4EE library based on the user's choice then dynamically reload the on-demand results on the map explorer.
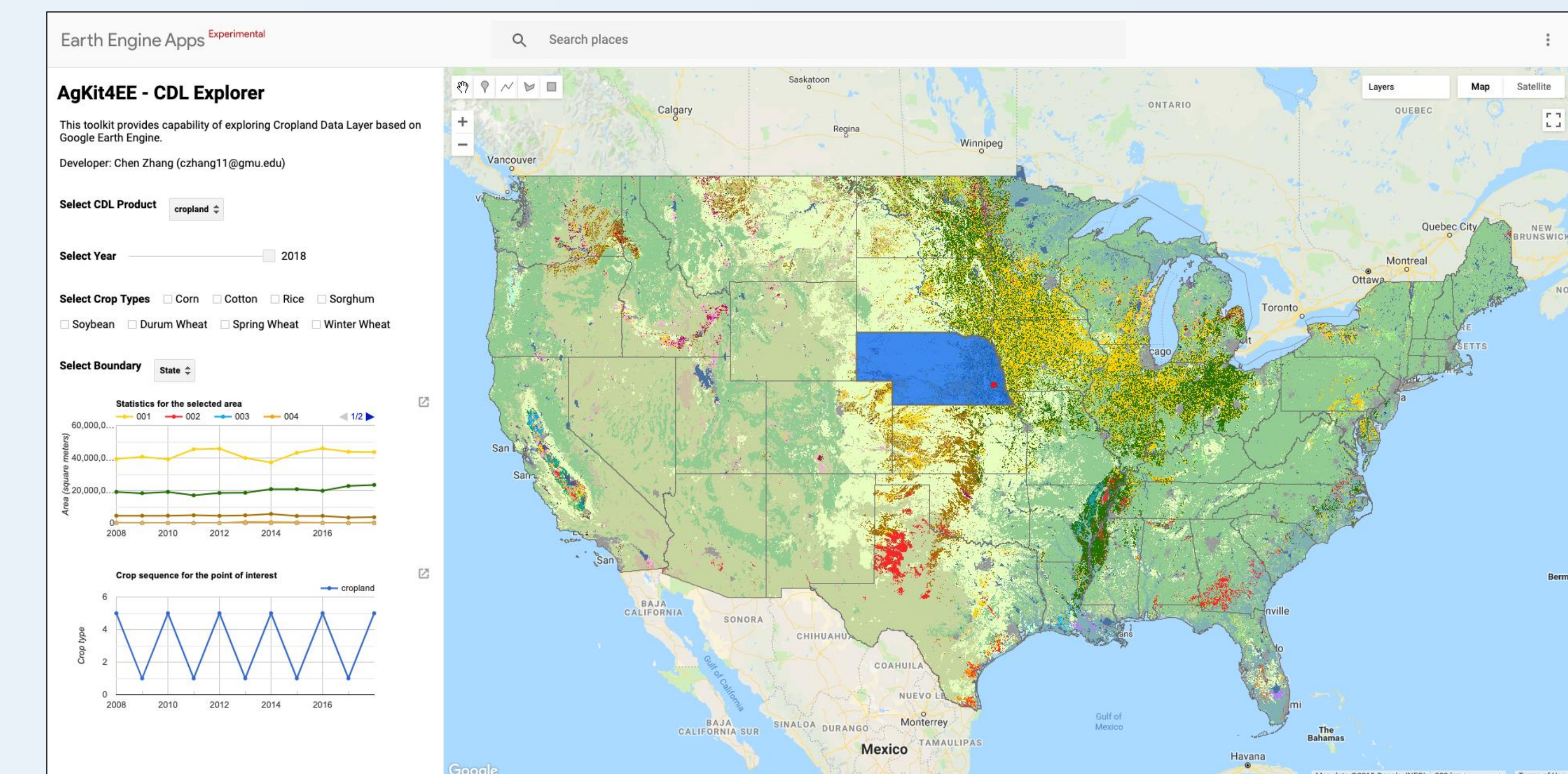
corn | soybeans | cotton | rice | spring wheat | winter wheat
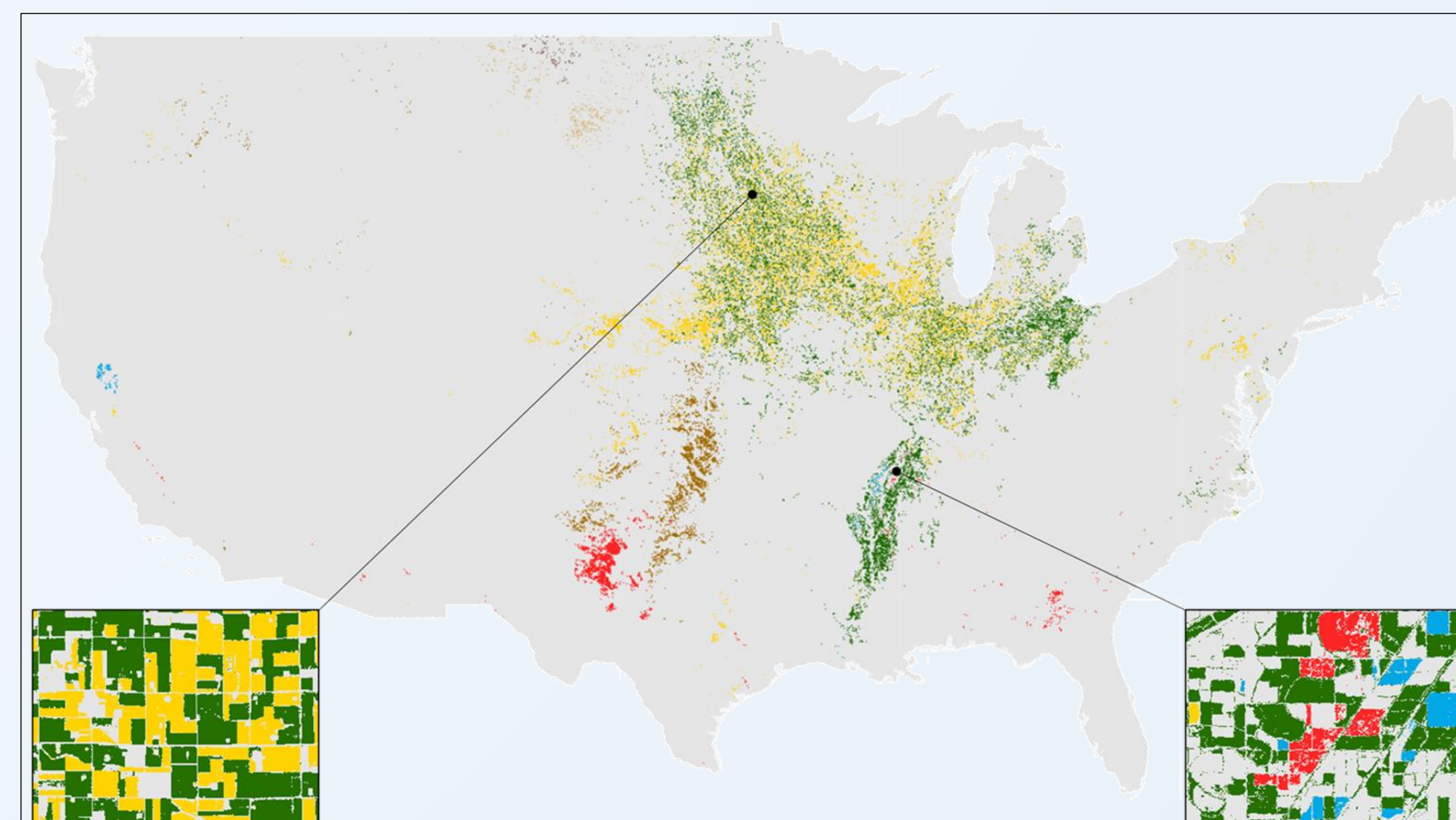
Crop rotation map of major crops over U.S. cropland
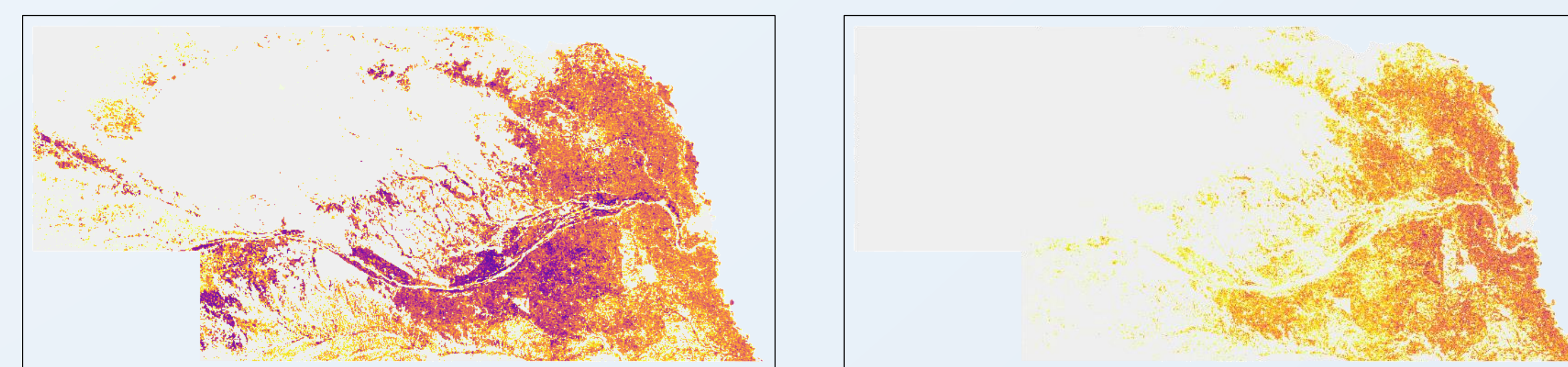
0 ▭▭▭▭▭▭▭▭ 21 (year)

Crop frequency maps of corn (left) and soybeans (right) over Nebraska

PROTOTYPES

Cropland Explore
https://czhang11.users.earthengine.app/view/agkit4ee-cdl-explorer
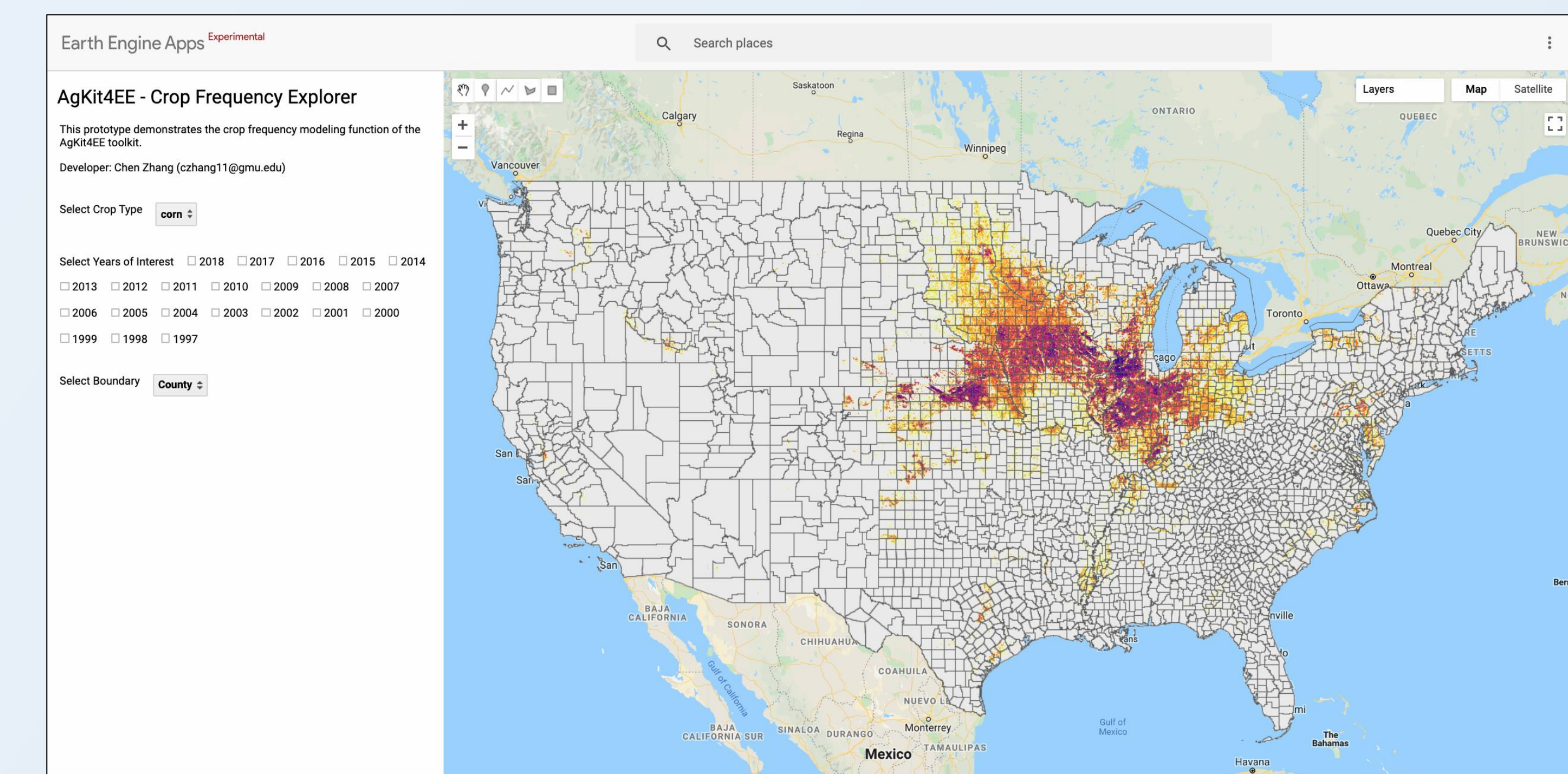
Crop Frequency Explorer
https://czhang11.users.earthengine.app/view/agkit4ee-crop-frequency-explorer

CITE THIS WORK

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SOFTWARE AVAILABILITY

Software Name: AgKit4EE
License: MIT
Technical Support: Chen Zhang (czhang11@gmu.edu)
GEE Project: https://code.earthengine.google.com/?accept_repo=users/czhang11/agkit4ee
Github repository: https://github.com/czhang11/agkit4ee

CONTACT INFORMATION

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