Trends.Earth - Developer Guide

version 2.2.10

Conservation International

April 22, 2026

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Developers Guide

Development

TRENDS.EARTH is free and open-source software, licensed under the GNU General Public License, version 2.0 or later.

There are a number of components to the TRENDS.EARTH tool. The first is a QGIS plugin supporting calculation of indicators, access to raw data, reporting, and production of print maps . The code for the plugin, and further instructions on installing it if you want to modify the code, are in trends.earth GitHub repository.

The TRENDS.EARTH QGIS plugin is supported by a number of different Python scripts that allow calculation of the various indicators on Google Earth Engine (GEE). These scripts sit in the “gee” sub-folder of that GitHub repository.

The plugin is also supported by a number of other modules:

- The *trends.earth-algorithms* module includes code for processing inputs and outputs for the plugin, as well as other common functions supporting calculation of NDVI integrals, statistical significance, and other shared code. The code for this module is available in the landdegradation repository on GitHub.
- The *trends.earth-schemas* module includes code for managing the schemas used for data input/output from *trends.earth*, including handling land cover classes, job parameters, structuring reports for UNCCD, and other related functions

Further details are below on how to contribute to Trends.Earth by working on the plugin GUI code, by modifying the processing code, or by contributing to translation of the website and plugin.

Modifying the QGIS Plugin code

Downloading the trends.earth code

The Trends.Earth code for both the plugin and the Google Earth Engine scripts that support it are located on GitHub in the trends.earth repository. Clone this repository to a convenient place on your machine in order to ensure you have the latest version of the code.

There are a number of different branches of the trends.earth repository that are under active development. The plugin officially supports QGIS3 and the majority of development is occurring on the “develop” branch. The “qgis2” branch is the older version of the plugin, and supports QGIS2 version 2.18+.

Installing dependencies

Python

The plugin is coded in Python. In addition to being used to run the plugin through QGIS, Python is also used to support managing the plugin (changing the version, installing development versions, etc.). Though Python is included with QGIS, you will also need a local version of Python that you can setup with the software needed to manage the plugin. The easiest way to manage multiple versions of Python is through the Anaconda distribution. For work developing the plugin, Python 3 is required. To download Python 3.7 (recommended) through Anaconda, see this page.

Python dependencies

In order to work with the trends.earth code, you need to have Invoke installed on your machine, as well as a number of other packages that are used for managing the documentation, translations, etc. These packages are all listed in the “dev” requirements file for Trends.Earth, so they can be installed by navigating in a command prompt to the root of the trends.earth code folder and typing:

```
pip install -r requirements-dev.txt
```

Note

If you are using Anaconda, you will first want to activate a Python 3.7 virtual environment before running the above command (and any of the other invoke commands listed on the page). One way to do this is by starting an “Anaconda prompt”, by following the instructions on this Anaconda page.

PyQt

PyQt5 is the graphics toolkit used by QGIS3. To compile the user interface for Trends.Earth for QGIS3 you need to install PyQt5. This package can be installed from pip using:

```
pip install PyQt5
```

Note

PyQt4 is the graphics toolkit used by QGIS2. The best source for this package on Windows is from the set of packages maintained by Christoph Gohlke at UC Irvine. To download PyQt4, select the appropriate package from this page. Choose the appropriate file for the version of Python you are using. For example, if you are using Python 2.7, choose the version with “cp27” in the filename. If you are using Python 3.7, choose the version with “cp37” in the filename. Choose “amd64” for 64-bit python, and “win32” for 32-bit python.

After downloading from the above link, use `pip` to install it. For example, for the 64-bit wheel for Python 3.7, you would run:

```
pip install PyQt4-4.11.4-cp37-cp37m-win_amd64.whl
```

Changing the version of the plugin

The convention for Trends.Earth is that version numbers ending in an odd number (for example 0.65) are development versions, while versions ending in an even number (for example (0.66) are release versions. Development versions of the plugin are never released via the QGIS repository, so they are never seen by normal users of the plugin. Odd-numbered development versions are used by the Trends.Earth development team while testing new features prior to their public release.

If you wish to make changes to the code and have downloaded a public release of the plugin (one ending in an even number), the first step is to update the version of the plugin to the next sequential odd number. So, for example, if you downloaded version 0.66 of the plugin, you would need to update the version to be 0.67 before you started making your changes. There are several places in the code where the version is mentioned (as well as within every GEE script) so there is an invoke task to assist with changing the version. To change the version to be 0.67, you would run:

```
invoke set-version -v 0.67
```

Running the above command will update the version number every place it is referenced in the code. To avoid confusion, never change the version to one that has already been released - always INCREASE the value of the version tag to the next odd number.

Testing changes to the plugin

After making changes to the plugin code, you will need to test them to ensure the plugin behaves as expected, and to ensure no bugs or errors come up. The plugin should go through extensive testing before it is released to the QGIS repository (where it can be accessed by other users) to ensure that any changes to the code do not break the plugin.

To test any changes that you have made to the plugin within QGIS, you will need to install it locally. There are invoke tasks that assist with this process. The first step prior to installing the plugin is ensuring that you have setup the plugin with all of the dependencies that it needs in order to run from within QGIS. To do this, run:

```
invoke plugin-setup
```

The above task only needs to be run immediately after downloading the trends.earth code, or if any changes are made to the dependencies for the plugin. By default `plugin-setup` will re-use any cached files on your machine. To start from scratch, add the `-c` (clean) flag to the above command.

After running `plugin-setup`, you are ready to install the plugin to the QGIS plugins folder on your machine. To do this, run:

```
invoke plugin-install
```

After running the above command, you will need to either 1) restart QGIS, or 2) use the Plugin Reloader to reload the Trends.Earth plugin in order to see the effects of the changes you have made.

By default `plugin-install` will overwrite any existing plugin files on your machine, but leave in place any data (administrative boundaries, etc.) that the plugin might have downloaded. To start from scratch, add the `-c` (clean) flag to the above command. You may need to close QGIS in order to successfully perform a clean install of the plugin using the `-c` flag.

Note

By default plugin-install assumes you want to install the plugin to be used in QGIS3. To install the plugin for use in QGIS3, add the flag `-v 2` to the `plugin-install` command. Remember the plugin may or may not be entirely functional on QGIS3 - the plugin was originally designed for QGIS2 and is still being tested on QGIS3.

Updating the cached boundaries list

When the geoBoundaries dataset is refreshed, update the cached list bundled with the plugin by running:

```
invoke download-boundaries-cache
```

The task authenticates against the Trends.Earth API. Configure credentials by adding an `invoke.yaml` file in the repository root with entries such as:

```
trends_earth_api:
    user: "you@example.com"
    password: "your-password"
```

You can also supply credentials via the `TRENDS_EARTH_API_USER` and `TRENDS_EARTH_API_PASSWORD` environment variables before invoking the task.

Building a plugin ZIP file

There are several invoke tasks to help with building a ZIP file to deploy the plugin to the QGIS repository, or to share the development version of the plugin with others. To package the plugin and all of its dependencies into a ZIP file that can be installed following the process described in the Trends.Earth readme, run:

```
invoke zipfile-build
```

This command will create a folder named `build` at the root of the trends.earth code folder, and in that folder it will create a file called `LDMP.zip`. This file can be shared with others, who can use it to manually install Trends.Earth. This can be useful if there is a need to share the latest features with someone before they are available in the publicly released version of the plugin.

Deploying the development version ZIP file

The Trends.Earth GitHub page gives a link to a ZIP file that allows users who may not be developers to access the development version of Trends.Earth. To create a ZIP file and make it available on that page (the ZIP file is stored on S3), run:

```
invoke zipfile-deploy
```

This command will package the plugin and copy it to https://s3.amazonaws.com/trends.earth/sharing/LDMP.zip.

Note

The above command will fail if you do not have keys allowing write access to the `trends.earth` bucket on S3.

Modifying the Earth Engine processing code

The Google Earth Engine (GEE) processing scripts used by Trends.Earth are all stored in the “gee” folder under the main trends.earth folder. For these script to be accessible to users of the trends.earth QGIS plugin, they have to be deployed to the api.trends.earth service Conservation International maintains in order to allow users of the plugin to use Earth Engine without the need to know how to program, or to have individual user accounts on GEE. The below describes how to test and deploy GEE scripts to be used with Trends.Earth.

Setting up dependencies

trends.earth-CLI

The “trends.earth-CLI” Python package is required in order to work with the api.trends.earth server. This package is located on GitHub in the trends.earth-CLI repository.

The first step is to clone this repository onto your machine. We recommend that you clone the repository into the same folder where you the trends.earth code. For example, if you had a “Code” folder on your machine, clone both the trends.earth repository (the code for the QGIS plugin and associated GEE scripts) and also the trends.earth-CLI repository into that same folder.

When you setup your system as recommended above, trends.earth-CLI will work with the invoke tasks used to manage trends.earth without any modifications. If, however, you download trends.earth-CLI into a different folder, then you will need to add a file named “invoke.yaml” file into the root of the trends.earth repository, and in that file tell Trends.Earth where to locate the trends.earth-CLI code. This YAML file should look something like the below (if you downloaded the code on Windows into a folder called “C:/Users/azvol/Code/trends.earth-CLI/tecli”):

```
gee:
    tecli: "C:/Users/azvol/Code/trends.earth-CLI/tecli"
```

Again, you **do not** need to add this .yaml file if you setup your system as recommended above.

docker

The trends.earth-CLI package requires docker in order to function. Follow these instructions to install docker on Windows, and these instructions to install docker on Mac OS. If you are running Linux, follow the instructions on this page that are appropriate for the Linux distribution you are using.

Testing an Earth Engine script locally

After installing the trends.earth-CLI package, you will need to setup a .tecli.yml file with an access token to a GEE service account in order to test scripts on GEE. To setup the GEE service account for tecli, first obtain the key for your service account in JSON format (from the google cloud console), then and encode it in base64. Provide that base64 encoded key to tecli with the following command:

```
invoke tecli-config set EE_SERVICE_ACCOUNT_JSON key
```

where “key” is the base64 encoded JSON format service account key.

While converting a script specifying code to be run on GEE from JavaScript to Python, or when making modifications to that code, it can be useful to test the script locally, without deploying it to the api.trends.earth server. To do this, use the `run` invoke task. For example, to test the “land_cover” script, go to the root directory of the Trends.Earth code, and, in a command prompt, run:

```
invoke tecli-run land_cover
```

This will use the trends.earth-CLI package to build and run a docker container that will attempt to run the “land_cover” script. If there are any syntax errors in the script, these will show up when the container is run. Before submitting a new script to api.trends.earth, always make sure that `invoke tecli-run` is able to run the script without any errors.

When using `invoke tecli-run` you may get an error saying:

```
Invalid JWT: Token must be a short-lived token (60 minutes) and in a
reasonable timeframe. Check your iat and exp values and use a clock with
skew to account for clock differences between systems.
```

This error can be caused if the clock on the docker container gets out of sync with the system clock. Restarting docker should fix this error.

Deploying a GEE script to api.trends.earth

When you have finished testing a GEE script and would like it to be accessible using the QGIS plugin (and by other users of Trends.Earth), you can deploy it to the api.trends.earth server. The first step in the process is logging in to the api.trends.earth server. To login, run:

```
invoke tecli-login
```

You will be asked for a username and password. These are the same as the username and password that you use to login to the Trends.Earth server from the QGIS plugin. **If you are not an administrator, you will be able to login, but the below command will fail**. To upload a script (for example, the “land_cover” script) to the server, run:

```
invoke tecli-publish -s land_cover
```

If this script already exists on the server, you will be asked if you want to overwrite the existing script. Be very careful uploading scripts with even-numbered versions, as these are publicly available scripts, and any errors that you make will affect anyone using the plugin. Whenever you are testing be sure to use development version numbers (odd version numbers).

After publishing a script to the server, you can use the *tecli-info* task to check the status of the script (to know whether it deployed successfully - though note building the script may take a few minutes). To check the status, of a deployed script, run:

```
invoke tecli-publish -s land_cover
```

If you are making a new release of the plugin, and want to upload ALL of the GEE scripts at once (this is necessary whenever the plugin version number changes), run:

```
invoke tecli-publish
```

Again - never run the above on a publicly released version of the plugin unless you are intending to overwrite all the publicly available scripts used by the plugin.

Editing vector layer templates

Trends.Earth allows users to digitize new vector features to delineate areas of special interest.

For now only “false positive/negative” layers are supported, but more can be added if necessary. Any vector layer is created from the template GeoPackage files, which can be found inside the `data/error_recode` folder of the plugin installation directory. For each vector type there are 6 template files, one for each UN official language. The ISO language code is added as a suffix to the file name. This is necessary to provide localized labels in the attribute forms. When creation of the vector layer is requested QGIS will look for the template file taking QGIS locale into account, as a fall-back option English version of the template file is used.

To change schema of the layer it is necessary to change corresponding template files in the `data/error_recode` folder of the plugin installation directory. Also template file contains a built-in default styling and attribute form configuration which will be automatically applied to the layer when loading into QGIS.

To display charts in the attribute form a built-in QML widget is used. Data for charts are stored in the vector layer attribute table. Values from the corresponding fields extracted with the help of expressions.

The code to generate charts looks like this:

```
import QtQuick 2.0
import QtCharts 2.0

ChartView {
```

```
    width: 380
    height:200
    margins {top: 0; bottom: 0; left: 0; right: 0}
    backgroundColor: "#eeeeec"
    legend.alignment: Qt.AlignBottom
    antialiasing: true
    ValueAxis {
        id: valueAxisY
        min: 0
        max: 100
    }

    BarSeries {
        id: mySeries
        axisY: valueAxisY
        axisX: BarCategoryAxis { categories: ["Productivity", "Land cover", "Soil organic carbon"] }
        BarSet { label: "Degraded"; color: "#9b2779"; values: [expression.evaluate("\"prod_deg\""), expression.evaluate("\"land_deg\""), expression.evaluate("\"soil_deg\"")] }
        BarSet { label: "Improved"; color: "#006500"; values: [expression.evaluate("\"prod_imp\""), expression.evaluate("\"land_imp\""), expression.evaluate("\"soil_imp\"")] }
        BarSet { label: "Stable"; color: "#ffffe0"; values: [expression.evaluate("\"prod_stab\""), expression.evaluate("\"land_stab\""), expression.evaluate("\"soil_stab\"")] }
    }
}
```

To extract field value function `expression.evaluate(""prod_deg"")` is used, the only argument it accepts is the name of the field. For false positive/negative layers chart contains three indicators: productivity, land cover and soil organic carbon. For each indicator plugin keeps three values stable, degraded and improved percentage of the polygon area. For example, in case of productivity indicator fields will be:

- prod_deg - degraded productivity
- prod_stab - stable productivity
- prod_imp - improved productivity

The same naming approach is applied to land cover (`land_*` fields) and soil organic carbon (`soil_*` fields).

Calculation of area percentage is done with custom expression function, its code can be found in the file `charts.py` in the plugin root directory. Function optimized to work with large polygons and uses following workflow. For a given geometry find a bbox and extract raster subset using this bbox. Perform in-memory geometry rasterization and apply it as a mask to raster. Then count number of pixels which have specific value and calculate percentage. As pixel counting is built on numpy array functions it is very fast even for big polygons.

On the first attempt to edit a vector layer the user will be presented with a dialog where they should select which datasets to use for indicators. Then plugin will setup default expression values for all indicator fields, so the value will be updated on every geometry change.

Dataset metadata handling

Dataset metadata are stored in the QGIS QMD format. These QMD files can be created for each raster individually and also for the whole dataset. Metadata editor dialog is opened from the **Edit metadata** menu in the Trends.Earth dock.

When dataset is exported to ZIP, conversion to ISO XML is performed using XSLT transformation. Corresponding transformation are located in the `data\xsl` subdirectory of the plugin installation folder.

Updating the Reporting Framework

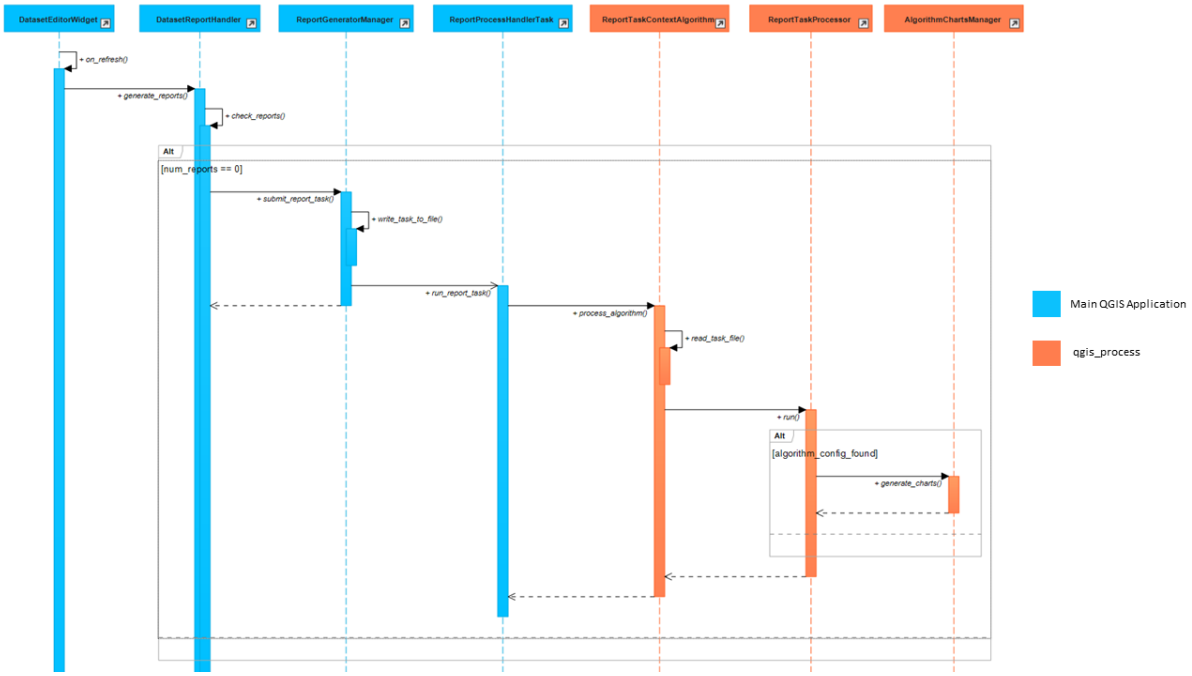
Overview of the Reporting Framework

The Reports Framework is designed to be extensible while also providing interactivity to the user through non-blocking operations. The Framework heavily leverages on `QgsProject` and `QgsPrintLayout` classes which are not thread safe hence, the use of `qgis_process` to do the heavy lifting of generating the reports (and charts). You can find more information about `qgis_process` here.

There are two main steps the toolbox performs when generating reports (and charts) for the default layers in a job:

1. It creates a `ReportTaskContext` object that constitutes a `ReportConfiguration` object (see Configuring Report Parameters) and a `Job` object that is represented in the **Datasets** panel. This `ReportTaskContext` object is serialized to a JSON file and then passed as one of the arguments in a `ReportProcessHandlerTask` object (that inherits from QgsTask).
2. The `ReportProcessHandlerTask` object initiates a separate instance of `qgis_process` and passes the path to the JSON file as an input to `trendsearth:reporttask` processing algorithm. This is a thin wrapper that deserializes the file to the `ReportTaskContext` object and passes it to a `ReportTaskProcessor` object that is responsible for generating the reports and the job's QGIS project. For algorithms that require charts, the `ReportTaskProcessor` object passes the job object to a `AlgorithmChartsManager` object which checks whether there is a chart configuration defined for the job's algorithm. If defined, it generates the corresponding charts as PNG files. (See Adding Chart Configurations for more information about chart configurations)

The diagram below provides a high-level illustration of this process:



** Click on the image for an enlarged view.*

> **Note**
>
> Some of the function names in the diagram above have been simplified for illustration purposes. The aforementioned classes can be found in the LDMP.reports and LDMP.processing_provider.report modules.

Adding Report Layout Variables

Report variables provide context information related to a job, layer (or band) or **`report_settings`** during the report execution process. Currently, the toolbox supports variables listed in the Layout Expression Variables section.

Each variable is defined as a `namedtuple` in the LDMP.reports.expressions module and, is subsequently updated and evaluated by the `ReportTaskProcessor` object.

Follow the guidelines below on how to add new job or current layer variables.

Job Variable

It enables information about the current job - being executed - to be added to a report layout. Information about each job variable is encapsulated in a `JobAttrVarInfo` object that is made up of four attributes:

Attribute Name	Description	Data Type	Default Value
job_attr	Attribute name of a `Job` object as used in a dot notation. For instance, *id* corresponds to `job.id`. You can even use the dot notation to refer to attributes in inner nested classes e.g. *results.uri.uri*.	String	N/A
var_name	Name of the report layout variable. It should be prefixed with *te_job_*.	String	N/A
default_value	A default value to use for *var_name*, mostly applied when designing layouts.	object	object
fmt_func	A function object that will be used to convert the job's attribute value to a format that is compatible with QGIS expressions. For instance, `str` can be used to convert the value of a job's *id* from UUID to string. You can also use lambda functions here.	function object	None

The code snippet below shows how to add a variable *te_job_result_name* that corresponds to `job.results.name`.

```
# LDMP/reports/expressions.py
def _job_attr_var_mapping() -> typing.List[JobAttrVarInfo]:
    return [
        ...
        JobAttrVarInfo('results.name', 'te_job_result_name', '', str),
        ...
    ]
```

Layer Variable

It provides information about the current raster layer being executed. This variable information is encapsulated in a `LayerVarInfo` object that is made up of three attributes:

Attribute Name	Description	Data Type	Default Value
var_name	Name of the report layout variable. It should be prefixed with *te_current_layer_*.	String	N/A
default_value	A default value to use for *var_name*, mostly applied when designing layouts.	object	object
fmt_func	A function object that will be used to extract and/or convert a value from a QgsRasterLayer object to a format that is compatible with QGIS expressions. You can also use lambda functions here. For instance, `lambda layer: layer.name()` returns the layer name.	function object	None

The code snippet below shows how to add a variable *te_current_layer_height* that corresponds to the raster layer's height.

```
# LDMP/reports/expressions.py
def _current_job_layer_var_mapping() -> typing.List[LayerVarInfo]:
    return [
        ...
        LayerVarInfo(
            'te_current_layer_height',
            '',
            lambda layer: layer.height()
        )
        ...
    ]
```

Note

These variables are only available in the layout scope.

Adding Chart Configurations

Charts can be grouped using a chart configuration object that corresponds to a specific algorithm. Defining a new chart configuration is a three-step process:

1. Create a new chart class that inherits from `BaseChart` in the LDMP.reports.charts module. Implement the `export` function to specify the chart type, properties etc. using the `Plotly` Python library that ships with QGIS. Finally, within the `export` function, call the `save_image` function to write the Plotly's `Figure` object as an image file using any of the formats supported by Qt's `QImageWriter` class. You can also specify the path as relative to the root output directory which is also available as an attribute in the base class. See the code snippet below:

```
# LDMP/reports/charts.py
Class MyCustomChart(BaseChart):
    def export(self) -> typing.Tuple[bool, list]:
        status = True
        messages = []

        # Create chart Figure using Plotly and set properties
        fig = go.Figure(...)

        # Add warning or error messages
        messages.append('Colour list not supported.')

        # Set image path in dataset's reports folder
        img_path = f'{self.root_output_dir}/chart-NDVI.png'

        # Save image and append its path
        self.save_image(fig, img_path)
        self._paths.append(img_path)

        return status, messages
```

   You can refer to the `UniqueValuesPieChart` class for a more complete example.

2. Create a chart configuration class that inherits from `BaseAlgorithmChartsConfiguration` and implement the `_add_charts` function. The chart configuration class basically defines which charts will be used for a given algorithm. The `layer_band_infos` attribute is a list of `LayerBandInfo` objects that contains the layer and band_info data required to produce the charts. You can refer to the `LandCoverChartsConfiguration` class for a more complete example.

3. Finally, map an algorithm (name) to the correspond chart configuration class in the `AlgorithmChartsManager` class as shown below:

```
# LDMP/reports/charts.py
Class AlgorithmChartsManager:
    def _set_default_chart_config_types(self):
        ...
        self.add_alg_chart_config('land-cover', LandCoverChartsConfiguration)
        self.add_alg_chart_config('productivity', MyCustomLandProductivityChartsConfiguration)
        ...
```

The `AlgorithmChartsManager` class, which is instantiated in the `ReportTaskProcessor` object, will create a new chart configuration object for a corresponding job's algorithm when reports are being generated.

Contributing to the documentation

Overview

The documentation for Trends.Earth is produced using Sphinx, and is written in reStructuredText format. If you are unfamiliar with either of these tools, see their documentation for more information on how they are used.

The documentation for Trends.Earth is stored in the "docs" folder under the main trends.earth directory. Within that folder there are a number of key files and folders to be aware of:

- build: contains the build documentation for trends.earth (in PDF and HTML format). Note it will only appear on your machine after running the `docs-build` invoke task.
- i18n: contains translations of the documentation into other languages. The files in here are normally processed automatically using invoke tasks, so you shouldn't ever have reason to modify anything in this folder.
- resources: contains any resources (primarily images or PDFs) that are referred to in the documentation. Currently there is only one folder ("EN", for English) as all of the images in the documentation are from the English version of the plugin - if appropriate additional folders can be added under "resources" with two-letter language codes to include images specific to a particular language.
- source: contains the reStructuredText source files that define the documentation (these are the actual English text of the documentation, and are the files you are most likely to need to modify).

Installing dependencies

Python dependencies

In order to work with the documentation, you need to have invoke, Sphinx, sphinx-intl, and sphinx-rtd-theme (the theme for the Trends.Earth website) installed on your machine. These packages are all listed in the "dev" requirements file for Trends.Earth, so they can be installed by navigating in a command prompt to the root of the trends.earth code folder and typing:

```
pip install -r requirements-dev.txt
```

LaTeX

LaTeX is used to produce PDF outputs of the documentation for Trends.Earth.

To install on Windows, follow the process outlined here to install the proTeXt distribution of LaTeX from the zipfile available here. The LaTeX installer is quite large (several GB) so it might take some time to download and install.

On MacOS, MacTeX is a good option, and can be installed following the instructions here.

On Linux, installing LaTeX should be much easier - use your distribution's package manager to find and install whatever LaTeX distribution is included by default.

Qt Linguist

Qt Linguist is also needed in order to pull strings from the code and GUI for translation. The "lrelease" command must be available and on your path. Try trying:

```
lrelease
```

within a terminal window. If the file is not found, you'll need to install Qt Linguist. This page is one source of installers for Qt Linguist. Once you install Qt Linguist ensure you add the folder containing lrelease to your path so that the Trends.Earth invoke script can find it.

Updating and building the documentation

Once you have installed the sphinx requirements, you are ready to begin modifying the documentation. The files to modify are located under the "docs\source" folder. After making any changes to these files, you will need to build the documentation in order to view the results. There are two versions of the Trends.Earth documentation: an HTML version (used for the website) and a PDF version (for offline download). To build the documentation for Trends.Earth, use the "docs-build" invoke task. By default, this task will build the full documentation for Trends.Earth, in HTML and PDF, for all supported languages. This can take some time to run (up to a few hours). If you are just testing the results of some minor changes to the documentation, it is usually best to use the `-f` option (for "fast"). This option will build only the English HTML documentation, which should take only a few seconds. To build using the fast option, run:

```
invoke docs-build -f
```

The above command will take a few seconds to run, and then if you look under "docs\build\html\en", you will see the HTML version of the documentation. Load the "index.html" file in a web browser to see how it looks.

To build the full documentation, for all languages, in PDF and in HTML (remember this could take a few hours to complete), run:

```
invoke docs-build
```

After running the above command you will see (for English) the HTML documentation under "docs\build\html\en", and the PDFs of the documentation under "docs\build\html\en\pdfs".

If you want to test a specific language (when testing translations, for example), you can specify a two letter language code to only build the docs for that language. For example, to build the Spanish documentation only, run:

```
invoke docs-build -l es
```

Note that options can be combined, so you can use the fast option to build only the HTML version of the Spanish documentation by running:

```
invoke docs-build -f -l es
```

When building the full documentation for the website, it is a good idea to first remove any old builds of the documentation, as they might contain files that are no longer used in the updated documentation. To do this, use the `-c` (clean) option:

```
invoke docs-build -c
```

In general, docs-build MUST complete without any errors if you are planning to share the documentation or post it on the website. However, when testing things locally, you might want to ignore documentation errors that pop up only for some of the languages (due to syntax errors arising from translation errors, etc.), and continue building the remaining documentation regardless of whether there are any errors. To do this, use the `-i` (ignore errors) option:

```
invoke docs-build -i
```

Whenever you make any changes to the text of the documentation, it is a good idea to push the latest strings to Transifex so they can be translated. To update the strings on Transifex with any new changes, run:

```
invoke translate-push
```

> **Note**
>
> To successfully run the above command you will need to have the key for the Trends.Earth transifex account.

Building documentation for release

Before releasing new documentation, always pull the latest translations from Transifex so that all translations are up to date. To do this, run:

```
invoke translate-pull
```

To build a version of the documentation for public release (either to the website, or in PDF) you must build the entire documentation using `docs-build` with no additional parameters:

```
invoke docs-build
```

This process must complete successfully with no errors. If any errors occur during the process, review the error message, and make any modifications needed to allow the build to complete successfully. Once the build completes with no errors, the files are ready to be deployed on the website.

> **Note**
>
> Both of the above commands also have `-f` (force) options that force pulling or pushing the latest translations from or to Transifex (respectively). Only use these options if you are VERY sure of what you are doing, as they can completely overwrite the translations on Transifex, leading to lost work done by the translators if the latest translations have not yet been committed to github.

Adding new documentation text

Any new .rst files that are added to the documentation need to be added to several configuration files to ensure they appear in the navigation menu, that they are properly translated, and (for tutorials) to ensure that they are generated in PDF so they can be downloaded for offline use.

- docs\source\index.rst: add new .rst files in the appropriate place here to ensure that they are linked to from the navigation menu.
- .tx\config: list new .rst files here (in the same format as the other files already included) in order to make the translation software aware of them so that they can be translated
- docs\source\conf.py: if you want to generate a PDF file of page of the website, then you must list that page here in the `latex_documents` list. Usually we do this only for tutorial pages that we want to make available to workshop participants in individual PDFs. Every page on the site will be included in the PDF version of the website as a whole, regardless of whether it is in the `latex_documents` list.

Adding new images or other resources

Any new images or other resources (PDFs, etc.) that are needed by the documentation should be added under “docs\resources\en”. If desired, it is possible to upload different versions of an image so that the image appears with the proper translations. This could be useful if you want to show the GUI interface in the appropriate language, for example. to do this, first upload a copy of the image to “docs\resourcesen” (with English text in it). Then, create a copy of the image with translated text and place that image under the appropriate folder for that language (for example an image showing Spanish translations would go under “docs\resources\es”). The English version of the image will be used as the default for all languages for which a native version of the image is not provided, while a localized version will be used when available.

Note

There is another folder, `docs\source\static`, that is used to hold resources temporarily while running the scripts that build the Trends.Earth documentation. You may have images listed under that folder if you have ever built the documentation on that machine. **This folder should never be used to add new resources** - new resources should always go under `docs\resources\en` or, for translated images, the appropriate language-specific folder under `docs\resources`.

Contributing as a translator

The translations for both the QGIS plugin and also for this site are managed by transifex. If you’d like to contribute to translating the plugin and documentation (and we’d love to have your help!) you can request to join our team through transifex, or by emailing us at trends.earth@conservation.org.

Releasing a new plugin version

Overview

Releasing a new version of Trends.Earth involves updating version numbers, creating git tags, building the plugin package, and publishing it to both GitHub and the QGIS plugin repository. The process is streamlined through invoke tasks that automate most of these steps.

Release workflow

Follow these steps in order to create a new public release:

1. Update the changelog

First, update the changelog in `LDMP\metadata.txt` with details about what has changed in this version. Include the version number and release date, followed by bullet points describing new features, bug fixes, and other changes.

2. Set the version number

Run the `set-version` task to update version numbers throughout the codebase:

```
invoke set-version -v X.Y.Z -m
```

Where X.Y.Z is the new version number (e.g., 2.1.20). The `-m` flag ensures that version numbers are also updated in the dependent modules (`trends.earth-schemas` and `trends.earth-algorithms`).

This command will:

- Update `LDMP/metadata.txt` with the new version
- Generate `LDMP/_version.py` with git information
- Update version in documentation (`docs/source/conf.py`)
- Set the `experimental` flag based on even/odd version numbers (even = stable, odd = development)
- Update dependency references in requirements files

Note

For stable releases (even version numbers like 2.1.18), the `set-version` task will update dependency references to use tagged versions. For development releases (odd version numbers like 2.1.19), it will use the master branch.

3. Update GEE scripts (if applicable)

If you have made changes to the Google Earth Engine scripts (in the `gee` folder) or to `trends.earth-schemas` or `trends.earth-algorithms`, add the `-g` flag when running `set-version`:

```
invoke set-version -v X.Y.Z -m -g
```

This will update version numbers in all GEE script configuration files. Before publishing, create release tags for the dependent repositories so the GEE scripts resolve the correct versions:

```
# In trends.earth-schemas (where x.y.z is the new version number
invoke set-tag -v x.y.z

# In trends.earth-algorithms (where x.y.z is the new version number)
invoke set-tag -v x.y.z
```

Once both dependencies are tagged, publish the updated scripts to the Trends.Earth API server:

```
invoke tecli-publish
```

This uploads all GEE scripts to api.trends.earth so they are available to plugin users. You must be an administrator to run this command successfully.

4. Commit all changes

Ensure all modified files are committed to git:

```
git add -A
git commit -m "Release version X.Y.Z"
```

5. Create and push git tags

After committing the release changes in this repository, run `invoke set-tag`:

```
invoke set-tag -v x.y.z # (where x.y.z is the new version number
```

This creates the plugin's annotated git tag (e.g., `v2.1.20`) and pushes it to GitHub. If you have uncommitted changes, the task will prompt you to commit them first.

6. Create GitHub release

Run the `release-github` task to create a release on GitHub with the plugin zipfile attached:

```
invoke release-github
```

This command will:

- Build a clean plugin zipfile (e.g., `LDMP_2.1.20.zip`) with all dependencies
- Remove all `.pyc` files to comply with QGIS repository security requirements
- Create a GitHub release with plugin zipfile attached as a downloadable asset

> **Note**
>
> You will need a GitHub personal access token with `repo` scope configured in your `invoke.yaml` file for this command to work. See the error messages if authentication fails for instructions on creating a token.

7. Publish to QGIS repository

Finally, manually upload the plugin to the QGIS plugin repository:

1. Download the plugin zipfile (e.g., `LDMP_2.1.20.zip`) from the GitHub release you just created (it will be listed under "Assets")
2. Log in to the QGIS plugin repository
3. Navigate to your plugin management page
4. Upload the new version using the zip file

The QGIS repository will validate the zipfile and make it available to users through the QGIS plugin manager.

Version numbering conventions

Trends.Earth follows these version numbering conventions:

- **Even numbers** (e.g., 2.1.18, 2.1.20): Stable releases intended for public use
- **Odd numbers** (e.g., 2.1.19, 2.1.21): Development releases for testing new features

Development versions are never published to the QGIS repository and are used only by the development team for testing.

Changelog

This page lists the version history of TRENDS.EARTH.

2.2.10 (April 20, 2026)

- Fixed SDG 15.3.1 summary failing on multi-period datasets due to duplicate band name matching across periods

2.2.8 (April 17, 2026)

- Fixed custom data import (land cover, SOC, LPD) to correctly reproject rasters in non-WGS84 coordinate systems such as UTM

2.2.6 (April 13, 2026)

- Added experimental support for LDN counterbalancing analysis
- Moved file downloads to background tasks to keep the interface responsive
- Added local job logging for better troubleshooting of locally-run analyses
- Improved caching of area extents for faster dropdown loading
- Added support for parallel processing in te_algorithms
- Added documentation on SO2-3 indicator calculations
- Translation and dependency updates

2.2.4 (March 19, 2026)

- Thread safety and stability improvements across the API client, job manager, download system, and report generation
- Added option to change the API server URL
- Improved dataset filtering and widget caching for better performance
- Fixed data import dialogs for small screens
- Fixed handling of timeseries jobs
- Fixed plugin module reloading during upgrade to reduce errors after updating
- Added in-plugin news feed
- Added handling for Google Earth Engine terms of service change
- Optimized local caching of job results to improve plugin responsiveness
- Add styles for SPEI layers and NDVI integrals

- Documentation updates including new status map section, updated FAQ, and productivity metrics
- Translation and dependency updates

2.2.2 (January 28, 2026)

- Add option to turn email notifications on/off for job status updates
- Support importing custom land productivity (LPD) data and using it in UNCCD reporting
- Support loading results JSON files directly onto the map
- Updated password reset and new user signup process for security
- Fixed loading boundaries without login
- Added optional custom dataset clipping on import
- Constrain SOC calculations to respect baseline SOC data year (2000)
- Thread safety and stability improvements
- Documentation and translation updates

2.2.0 (November 24, 2025)

- Switch default boundary dataset from Natural Earth to geoBoundaries (basemaps still use Natural Earth)
- Ensure custom execution names propagate through UNCCD report, drought vulnerability, urban change, restoration biomass, and total carbon summary workflows
- Optimize basemap preparation by speeding up archive extraction and reducing duplicative operations
- Compress API requests and harden retry logic to reduce transient failures when communicating with trends.earth API
- Refresh documentation links and remove outdated fact sheets
- Update datasets available on https://data.trends.earth

2.1.20 (October 10, 2025)

- Add preset functionality for SDG 15.3.1 sub-indicator calculations, with defaults matching latest UNCCD reporting cycle
- Improve handling of failed or pending executions - all executions now always show in the datasets window unless deleted
- Support viewing job logs for remote executions
- Sync with latest te_schemas and te_algorithms versions, including better parallel processing support from latest te_algorithms
- Fix handling of FAO-WOCAT/JRC/Trends.Earth LPD dataset selection in SDG 15.3.1 sub-indicator calculation

- Optimize trends.earth-API interactions (using refresh tokens, and removing unnecessary requests)
- Use setuptools-scm to dynamically identify versions (most relevant for those running development versions of trends.earth)
- Bump googleearthengine-api to 1.6.6

2.1.18 (August 5, 2025)

- fix: key error with reporting period default selection by @merydian in #943
- fix: error in Sub-indicators for SDG 15.3.1 with progress periods by @merydian in #945
- Update translations by @github-actions[bot] in #946
- [pre-commit.ci] pre-commit autoupdate by @pre-commit-ci[bot] in #929
- Fix progress period included even when it is not checked by @dimasciput in #954
- Added nix shell for NixOS dev workflow streamlining by @timlinux in #950
- Qgis process by @timlinux in #955
- Final tweaks for experimental 2.1.18 by @timlinux in #956
- [pre-commit.ci] pre-commit autoupdate by @pre-commit-ci[bot] in #948
- Try to fig plugin setup issue by @azvoleff in #951
- Update translations by @github-actions[bot] in #958
- Add support multiple progress periods for SDG 15.3.1 by @merydian in #961
- Make reports work in FAO-WOCAT productivity mode for SDG 15.3.1 local task by @merydian in #963
- Update translations by @github-actions[bot] in #964
- Add support for CHIRPS and UK-CEH precipitation datasets in drought tools

2.1.16 (July 31, 2024)

- Bump dependency versions to address #812
- Fix deprecation of np.float
- Update datasets to latest versions (MODIS, CHIRPS, ESA CCI, PERSIAN, MODIS ET, Hansen Global Forest Change)
- Switch to ruff for code formatting/linting
- For SDG 15.3.1 sub-indicators task, when population data is needed default to a dataset matching the final year of the productivity data, or within three years of that date if an exact match is not possible
- Various dependency version updates

2.1.14 (February 24, 2023)

- Improve land productivity import tool, including support for JRC, FAO-WOCAT, or Trends.Earth data, and option to specify initial and final years

2.1.12 (February 17, 2023)

- Improve data download tool, including support for downloading WorldPop population data used in UNCCD reporting

2.1.10 (February 7, 2023)

- Fix error when using shapefiles/geojsons to define aoi (#768)
- Ensure user settings are retained and not reset by offline mode checks
- Update translations

2.1.8 (January 25, 2023)

- Output JSON field for Prais containing updated false positive/negative calculations.
- Fixes #752 - false positive/negative datasets not showing up in non-English versions

2.1.6 (December 8, 2022)

- Bumps maximum number of land cover classes to 45 (useful particularly for users seeking to use Corine legend)
- Fix issue that was arising on Mac/Linux due to missing QgsPanelWidget ui file
- Various more minor bug fixes

2.1.6 (November 21, 2022)

- Fixes #691 (issue that arose if the base data directory was cleared). When base directory is cleared plugin will now reset the value to the default.
- Fix python error coming up when settings window was closed while datasets screen was not open.

2.1.2 (November 18, 2022)

- Fixes #724 - ensure max number of land cover classes is set to 38 by default (ignoring the previously set default value in qsettings, which used to be 32).
- Fixes #722 - file name casing when code refers to land_cover_transition_matrix_unccd.json.
- Fixes #726 - make dataset year visible in datasets window for imported datasets

2.1.0 (November 11, 2022)

- Moved plugin settings to live within main QGIS plugin settings window

- Bumped marshmallow-dataclass to 8.5.10 and marshmallow to 3.18.0. This necessitated changes in trends.earth-schemas, so it is possible some old jobs may not load in this new version (suggest re-running them if need be).

2.0.7 (October 31, 2022)

- Enable Excel table generation for SDG 15.3.1 when using custom classes - all the various minor bugs should now be worked out.
- Limit report generation to 3 tries - then quit trying to generate reports until next restart (prevents Trends.Earth continually spawing processes for report generation when they are failing).

2.0.5 (October 19, 2022)

- Fix SDG summary generation when using JRC LPD or WOCAT LPD.

2.0.3 (October 19, 2022)

- Allow bypassing reset of land cover legend when choosing defaults in the SDG tool.
- Disable excel generation when child legend does not have 7 classes.
- Fix report generation when using custom legend.

2.0.1 (October 13, 2022)

- Added ability to completely customize the land cover legend used in Trends.Earth, including the number, name, color, and coding of each class in the legend. This applies to all calculatons using land cover data, including the SDG 15.3.1 tool, and the productivity, soil organic carbon, and land cover indicator tools.
- Reworked land cover import tool to allow importing data and assigning classes to custom legend.
- Misc minor bug fixes.
- Add ability to include false positive/negative dataset in UNCCD report. Next release will include further functionality to apply and report on false positive/negatives.
- This experimental release disables the creation of Excel output tables for the SDG 15.3.1 tool. This functionality will be present in the next (stable) release.

2.0 (July 20, 2022)

- All new interface with simplified navigation screens and dataset loading
- Updated documentation and website
- Trends.Earth is now translated into all the official UN languages, as well as Portuguese. Swahili and Farsi translations (for the new interface) are planned as well.
- New functions to support latest UNCCD reporting cycle (including direct support for exporting results for upload to UNCCD PRAIS system)
- New functions to support assessing drought hazard, vulnerability, and exposure

- New timeseries tool functions (now supports plotting restrend, WUE, etc.)

1.0.10 (July 7, 2022)

- Address bug with TransformDirection related to changes in QGIS 3.22+

1.0.8 (October 15, 2021)

- Address bug in saving final layer for SDG calculation (related to issues #500, and #505)

1.0.6 (July 15, 2021)

- Remove trends.earth-schemas as a submodule and install through setup.py (much cleaner for version tracking, development, etc.)
- Fix bug in loading 2020 NDVI data in GEE code (asset name wasn't set right so 2020 wasn't loading)
- Various invoke tasks added to help with plugin development/release.

1.0.4 (June 30, 2021)

- Add WorldPop and Gridded Population of the World version 4 (GPWv4) to the datasets available through Trends.Earth
- Update to allow access to ESA-CCI land cover through 2020
- Update GPCC and GPCP datasets
- Fix bug when non-integer buffers are used
- Minor documentation typo fixes

1.0.2 (August 14, 2020)

- Fix urban area code to allow processing of AOIs with areas between 10,000 sq km and 25,000 sq km.
- Add latest MERRA2 data (through 2019).
- Remove maximum area limitation from download tool.
- Bump httplib2 to 0.18.0.
- Update from GPCC V6 to GPCC V7
- Add 2019 Hansen et al. deforestation data
- Update to latest colormap for degradation data (addressing issues with reg/green colorblindness).
- Add support for more datatypes in input shapefiles (add PointZ, MultiPoint, MultiPointZ, PolygonZ, MultiPolygonZ).
- Misc bugfixes to address Python errors that were coming up with some QMessageBox messages.

1.0.0 (April 27, 2020)

- Add ability to download and use pre-compiled binaries (compiled with Numba) to speed up some local calculations. Right now this only is available for the SDG15.3.1 summary table calculation, but eventually this will be expanded to other tools as well.
- Related to the above, there is now an “advanced” settings button in the settings window, that will allow users to download pre-compiled binaries, and to turn on or off detailed logging of messages while the tool is running. These log messages can be useful when trying to trouble-shoot problems if you encounter any.
- Improve checks for geometry validity for geometries in input files, and give an error message rather than throwing an exception when there are geometry errors.
- Fix processing using new MODIS data (assets were not properly updated in the last release)
- Fix color-coding of land covers in land cover class aggregation window
- Add more detailed version information to about dialog.
- Add additional detail to data download tool.
- Add job ID to downloads window to facilitate bug reporting.
- Minor bug fixes (sorting of jobs and downloads tables).

0.98 (April 2, 2020)

- First QGIS3 release - many fixes to upgrade to Qt5 and QGIS3 API.
- Upgrade all dependencies of plugin to latest versions as of January 2020.
- Fix data download tool to have default 1styles for all available datasets.
- Begin moving to QgsProcessing and QgsTask frameworks - currently only the carbon tool is migrated, but all tools will be migrated prior to version 1.0./
- Cleanup formatting of carbon tool output spreadsheet to make meaning of each column clearer.
- Update all GEE scripts to use latest version of GEE API (0.1.213).
- Save more settings chosen in tool dialog boxes across QGIS sessions.
- Clean up buffering code, to use Lambert Equal Area projections centered on polygon centroids for buffering.
- Move documentation into docs folder at root of trends.earth repository.
- Add more details on how to documentation on how to contribute to development of Trends.Earth,
- Clean up repository by removing compiled translations files, and adding these file types to .gitignore.
- Change transifex project name to be “trendsearth”.
- Various compatibility and minor bug fixes.

0.66 (July 20, 2019)

- Limit maximum area for tasks to 10,000,000 sq km, except for urban area tasks, which is limited to 10,000 sq km.

- Add background section on SDG 11.3.1, and update SDG 11.3.1 tutorial.
- Update SDG 11.3.1 code to include 1998 in the series (internally during calculation) in order to filter noise from the beginning of the urban series.
- Fix date restrictions in SDG 15.3.1 all-in-one tool to account for both ESA and MODIS availability.
- Add section to readme on how to install Github releases.
- Update and review Spanish translations, update google translations for other languages.

0.64 (July 9, 2019)

- Fix handling of nodata in total carbon tool.
- Add support for 2018 Hansen data in total carbon tool.
- Add support for global 30m biomass data from Wood's Hole in total carbon
- Set maximum final year for one step SDG 15.3.1 tool to be 2015 (matching the ESA data).
- Make Trends.Earth productivity the default dataset in SDG one step tool for 15.3.1.

0.62 (January 27, 2019)

- Add experimental tool for mapping potential carbon returns from alternative restoration interventions.
- Add 2018 MODIS data.
- Miscellaneous fixes to window sizing for GUI windows.
- Upgrade to latest openpyxl - fixes loading of Trends.Earth logo in summary tables.
- Add publication list to help docs.

0.60 (December 3, 2018)

- Add calculation of change in urban area and population growth rate (SDG 11.3.1)
- Fix default button/entry field heights Add city selection for AOI
- Add optional buffering of AOI

0.58 (August 11, 2018)

- Add a testing section to the calculations page
- Add testing version of total carbon (above and below-ground) and emissions due to deforestation
- Minor bug fixes, including for invalid polygons in input AOIs

0.56.5 (May 21, 2018)

- Fix error with LPD import requesting a data year.

0.56.4 (May 21, 2018)

- Always resample imported data to the highest resolution.
- Fix custom SOC import climate zones to use an expanded climate zones dataset to eliminate no data.
- Update MOD16A2 with latest data.
- Force entry of date on SOC and LC data import
- Add global Trends.Earth outputs to download tool.
- Fix handling of NULL values in legends.

0.56.3 (April 21, 2018)

- Fix calculation of summary tables for AOIs that are split across the 180th meridian (Fiji, Russia, etc.).
- Modify state calculation so areas with very small magnitude changes in NDVI integral (< .01 NDVI units over full period) are considered stable.

0.56.2 (April 10, 2018)

- Minor unicode fixes.

0.56.1 (April 10, 2018)

- Fix marshhmallow error on plugin load

0.56 (April 9, 2018)

- Fix issue with rasterizing data (empty rasters on output)
- Force user to choose output resolution if rasterizing a vector
- Support calculation of SOC degradation from custom SOC and LC data

0.54 (April 8, 2018)

- Support loading of custom LPD, SOC, and LC data.
- Cleanup styles so they match maps.trends.earth
- Upgrade pyopenxl
- Add import/load icons to all layer selector boxes

0.52.1 (March 21, 2018)

- Minor bug fixes during Antalya workshop.

0.52.1 (March 21, 2018)

- Minor bug fixes during Antalya workshop.

0.52 (March 19, 2018)

- Clean AOI processing code.

0.50 (March 15, 2018)

- Pass exception if only related to Trends.Earth logo addition in Excel file.
- Various minor bug fixes.

0.48 (March 13, 2018)

- Fix table formatting

0.46 (March 13, 2018)

- Support reporting table calculation with multiple geometries (Fiji, Russia)
- Add LPD and LC tables to UNCCD worksheet tab
- Clean up the warning message in the LPD import tool
- Fix TE final combined productivity layer loading
- Fix download tasks (still no styles)

0.44 (March 12, 2018)

- Add JRC LPD
- Add tool for uploading custom land cover data
- Add tool for uploading custom productivity data
- Add note that custom SOC upload is coming soon
- Add tool to add basemaps using Natural Earth data
- Add all-in-one tool for calculating all three sub-indicators at once
- Rename “Bare lands” class to “Other lands” for consistency with UNCCD
- Update docs
- Upgrade to marshmallow 3.0.0b7
- Move GEE code into the main trends.earth repository
- Improve handling of AOIs, particularly when shapefiles are used for input
- Handle multi-file outputs from GEE by tiling them in VRTs

- Support processing data for countries that cross the 180th meridian
- Improve formatting of summary table
- From now on, GEE script versions will be matched to the plugin version

0.42 (February 4, 2018)

- Fix crash on change of LC aggregation (due setEnabled on removed label)

0.40 (February 4, 2018)

- Remove use of mode for land cover indicator.
- Combine the summary table and SDG indicator map creation tools.
- Add stub for where JRC LPD product will be available.
- Save productivity sub-indicator as band 2 in SDG indicator file.
- Bump GEE script to v0.3.
- Fix error due to divide by zero on summary table generation when a class has zero area.
- Default to MODIS for productivity calculations.

0.38 (January 16, 2018)

- Add annual soil organic carbon calculation
- Cleanup AOI processing code, allow multiple input polygons in shapefile AOIs
- Add shading to side of land cover aggregation table items
- Fix firstShow issue on aggregation table
- Revise summary table output to provide further information on each of the three indicators
- Add supplemental datasets to performance, state, land cover and soil organic carbon output.
- Update no data and masking values to consistently be -32768 (no data) and -32767 (masked data)
- Allow naming of file downloads
- Add icon to toolbar menu, fix plugin name.
- Refactor layer styling code to pull band info from GEE output.
- Add a tool to load existing trends.earth datasets into QGIS.
- Fix land cover date limits - don’t allow invalid dates toi be selected from CCI data.

0.36 (December 14, 2017)

- Fix issue with showEvent on create map reporting tool.

0.34 (December 14, 2017)

0.32 (December 14, 2017)

0.30 (December 12, 2017)

0.24 (December 6, 2017)

0.22 (December 4, 2017)

0.18 (December 2, 2017)

0.16 (November 6, 2017)

0.14 (October 25, 2017)

0.12 (October 6, 2017)