Food and Agriculture Organization of the United Nations

FAO-GISMGR Project

GISMGR 2.0

User Manual

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Acronyms:

API	-	Application Programming Interface
COG	-	Cloud Optimized GeoTIFF
FAO	-	Food and Agriculture Organization of the United Nations
GIS	-	Geographic Information System
JSON	-	JavaScript Object Notation
JWT	-	JSON Web Token
PNG	-	Portable Network Graphics
ReST	-	Representational State Transfer
SLD	-	Styled Layer Descriptor
UI	-	User Interface
URL	-	Uniform Resource Locator

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1 Introduction and Overview

1.1 About this document

This document, the FAO GISMGR 2.0 WEB UI User Manual, provides information to data owners and supporting officers on using the FAO GISMGR 2.0 Web application to manage and publish data.

1.2 About FAO GISMGR 2.0

GISMGR 2.0 is a FAO project to import, manage, share and publish GIS raster data through ReST APIs or a Web User Interface. Data owners can use a shared working environment (**`workspace`**) to manage various resources and work with them as a cohesive unit, promoting collaboration between multiple businesses or individuals. GISMGR 2.0 manages the following resources:

- **`users` and `roles`**
  grant access and privileges to users with predefined roles:
  - Admin
  - Editor
  - Data Manager
  - Data Uploader
  - Data Viewer.

- **Cloud Storage buckets**
  `upload` and **`data`** buckets are provided to ingest data, transform and share results in COG format.

- **`styles`**
  create, import, update and export raster styles and legends using SLD, JSON or PNG formats.

- **`dimensions`**
  create, import, update and export dimensions and their dimension members in JSON or CSV.

- **grids**
  create, import, update and export grids in JSON or CSV.

- **`maps` (single raster layers)**
  ingest, transform, preview and share single raster data and their metadata. Handle different input formats, continuous or categorized rasters, and convert them to COG format, sharing their metadata as JSON files.

- **`mapsets` (multiple raster layers)**
  ingest, transform, preview and share multiple raster data and their metadata. Handle different input formats, continuous or categorized rasters, and convert them to COG format, sharing their metadata as JSON files.

- **`mosaicsets` (multiple “gridded” raster layers)**
  ingest, transform, preview and share multiple raster data in a grid and their metadata. Handle different input formats, continuous or categorized rasters, and convert them to COG format, sharing their metadata as JSON files.

2 FAO GISMGR 2 Web Application overview

FAO GISMGR 2.0 Web Application is a User Interface, built over FAO GISMGR 2.0 ReST API, to provide an intuitive way to manage data. Access to the application is protected. To access the application, the User must be registered in the system (sign up) and sign in. FAO GISMGR 2.0 web application can be accessed at the following link:

https://data.apps.fao.org/gismgr/web/v2/

2.1 Navigating the Web application

The Web application has a main menu on the left to access the different resources of the system. This menu, or part of it depending on the user authorizations, is enabled only when a Workspace is selected, since all resources belong to a specific workspace. For System Administrators, a Global Settings menu item is present at the bottom of the main menu.

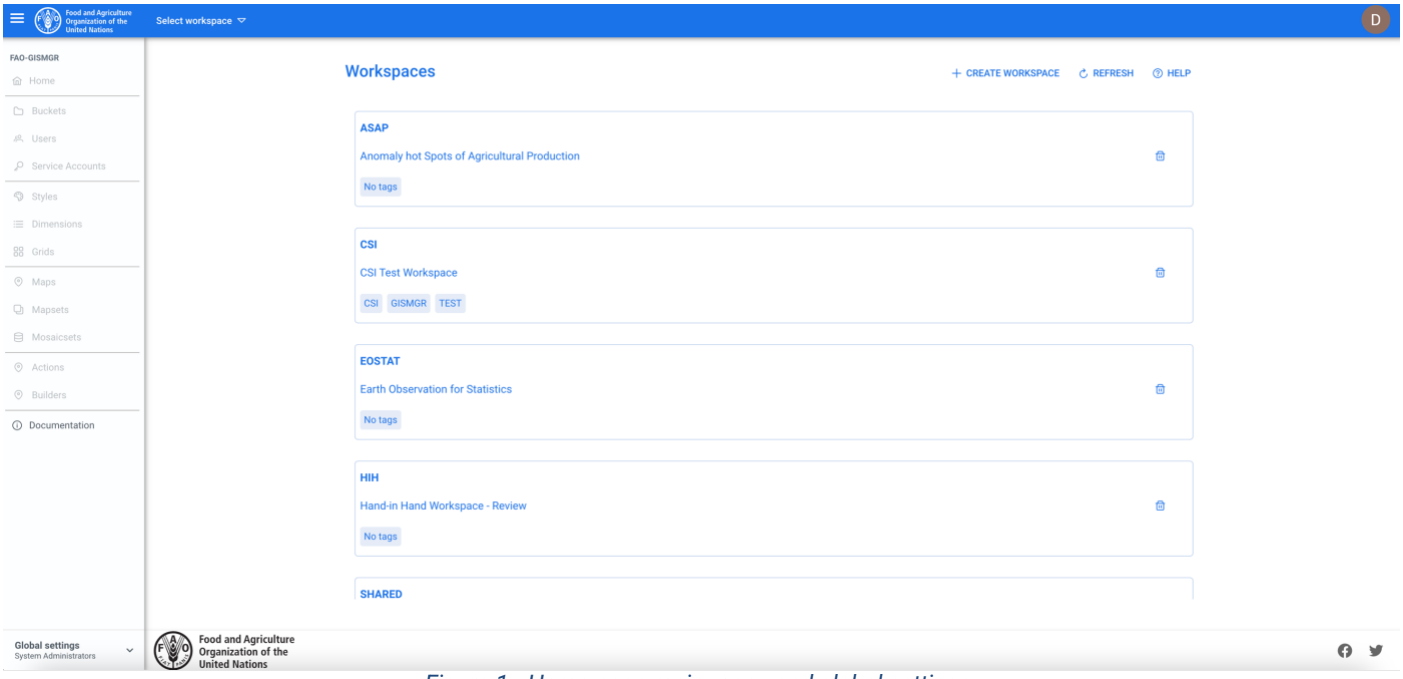

Figure 1 - Home page main menu and global settings.

From the top right avatar button, a User can access his profile page or sign out of the application.

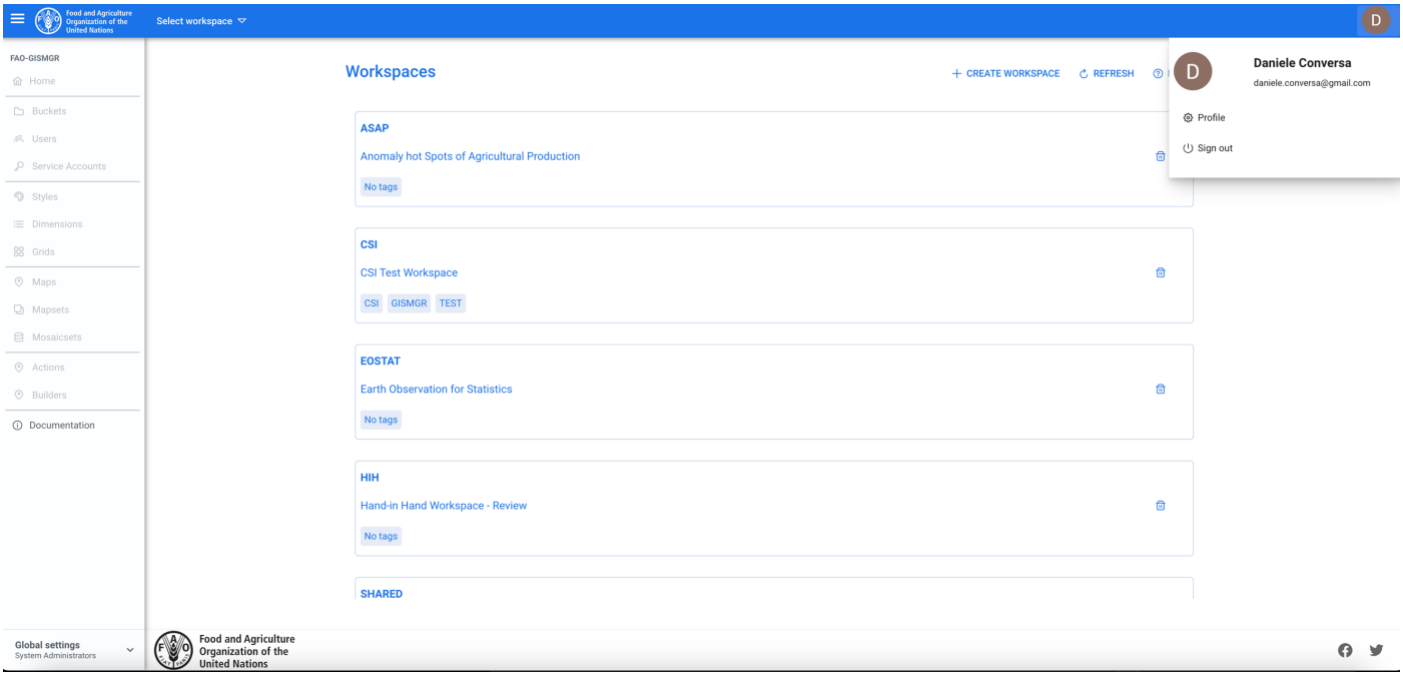

Figure 2 - Home page avatar menu

2.2 Maximizing the working area

The top left hamburger menu allows the User to show or hide the main menu on the left, leaving the full page available to display/edit the content.

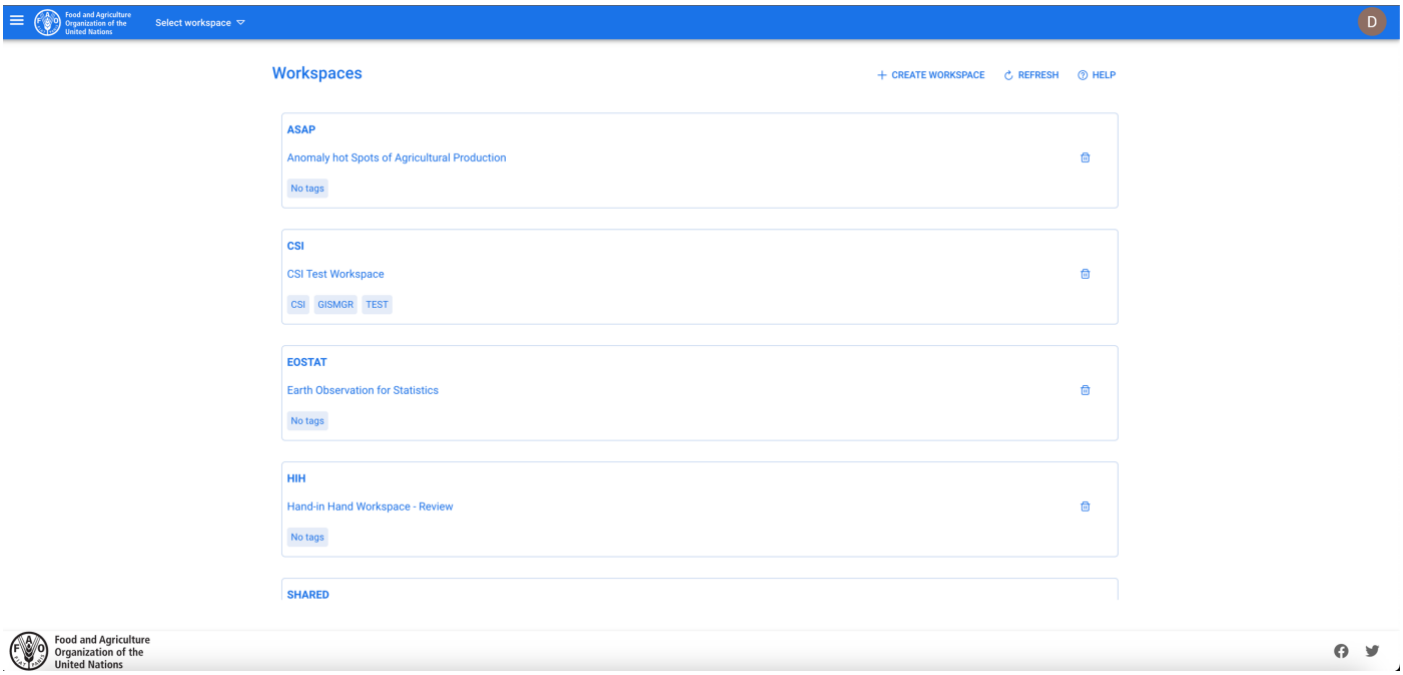

Figure 3 - Maximizing the working area, show/hide menu.

2.3 Viewing a resource

To view a resource (JSON Representation), the User must press the JSON button on the top right of the window. A popup will display the JSON representation of the selected resource. For some

resources (e.g., the Styles) it is possible to have different representations. In these cases, the corresponding buttons will be added aside the JSON one.

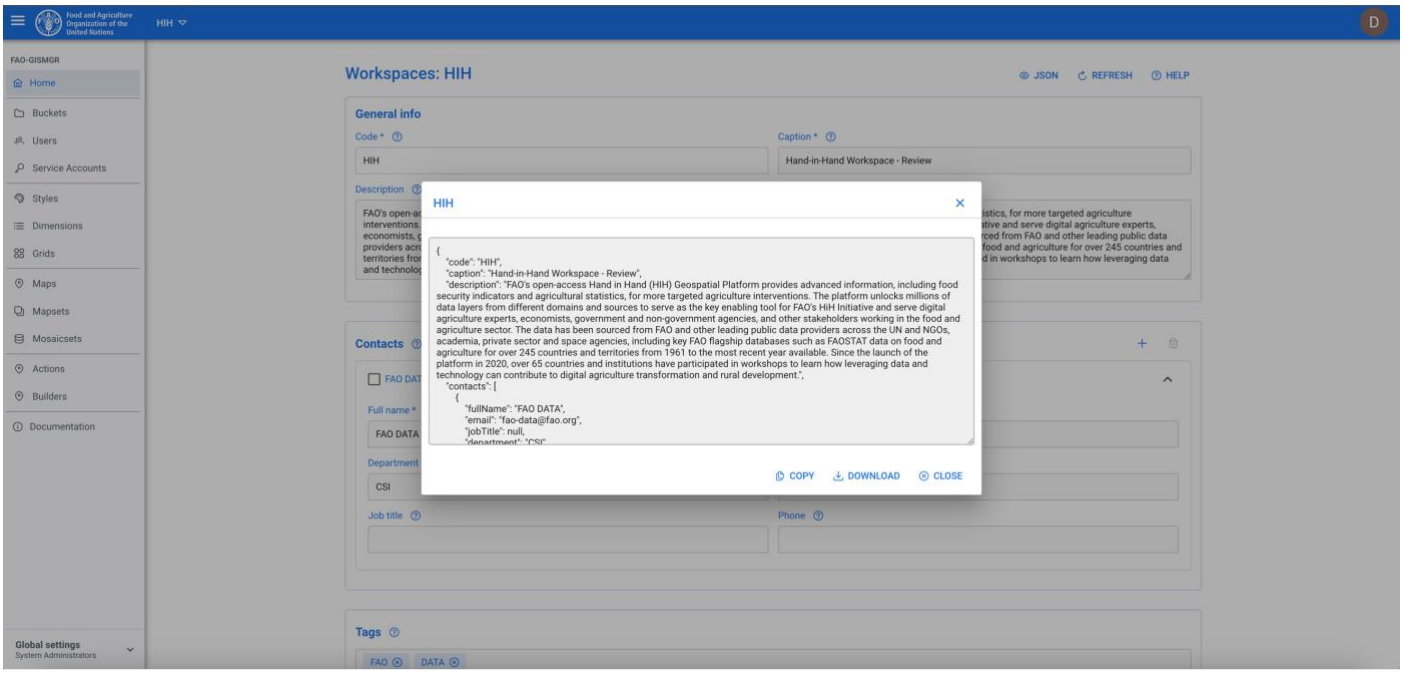

Figure 4 - View a resource.

2.4 System messages

The system informs the User of the status of the requests, whether these are completed successfully or with errors.

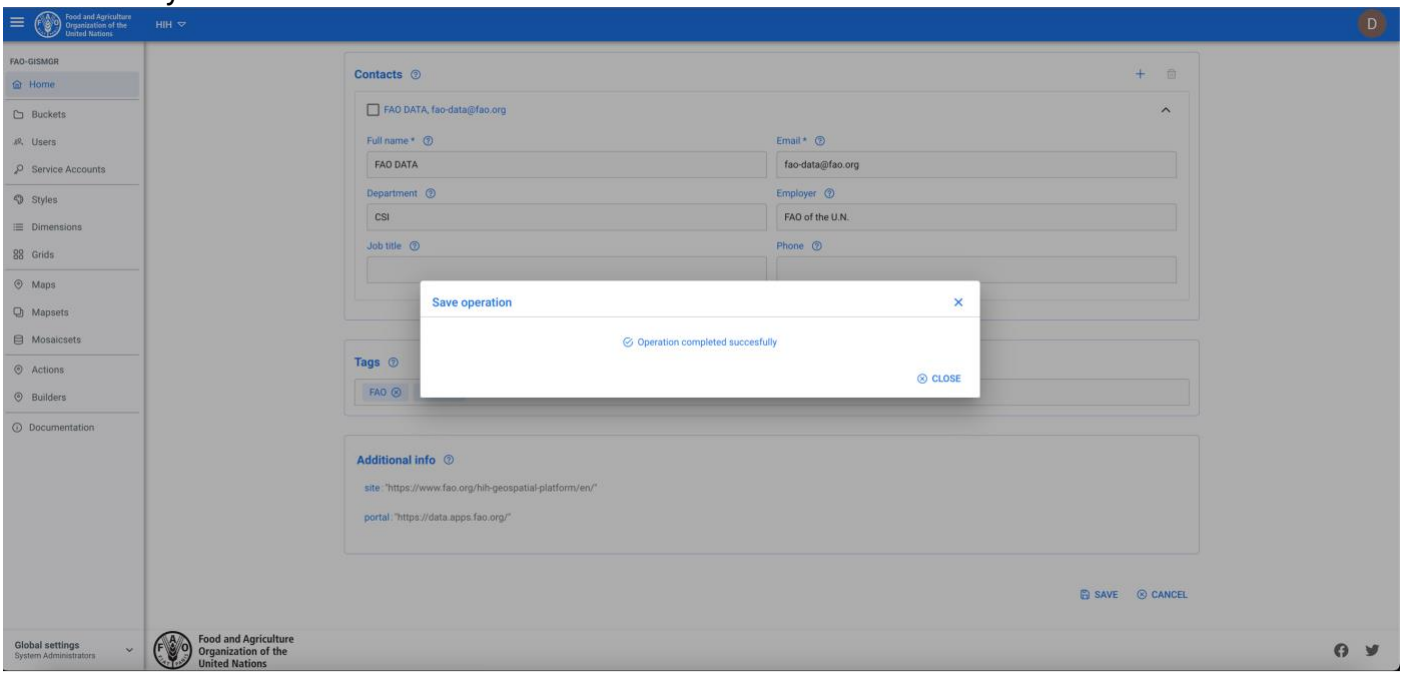

Figure 5 - Successful operation message.

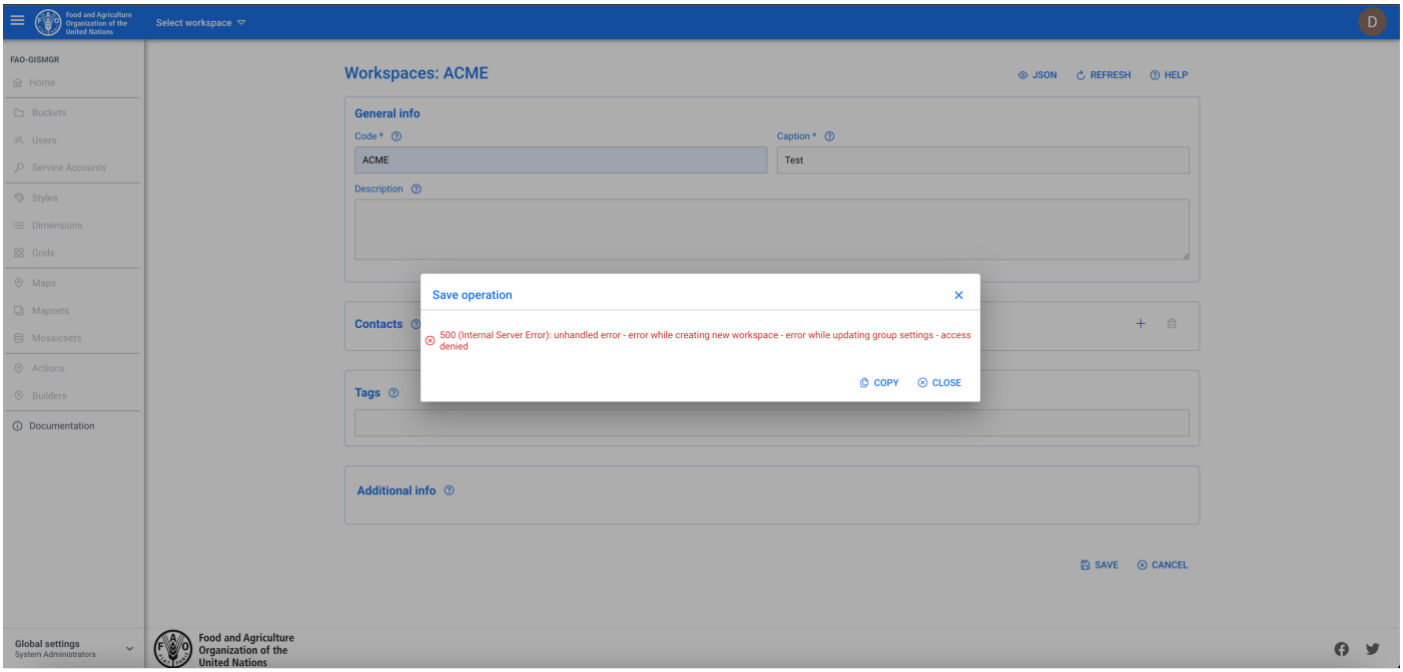

Figure 6 - Error message.

When entering data, required fields are marked with an asterisk (*) and, if there are validation errors, these are displayed as soon as the User attempts saving the page.

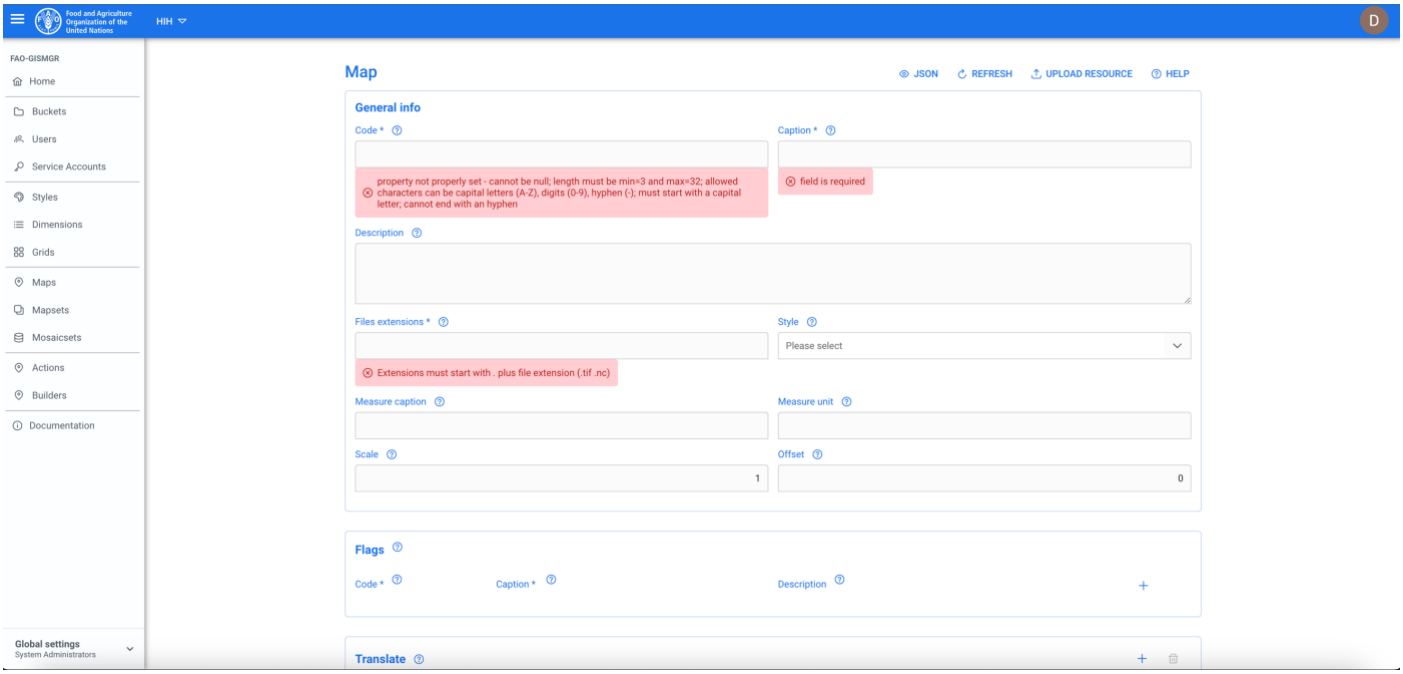

Figure 7 - Data validation error messages.

2.5 Deleting resources

Deleting data is **irreversible** therefore, before deleting a resource, the system always displays a confirmation message to avoid undesired deletion of data. Only after confirmation data is deleted.

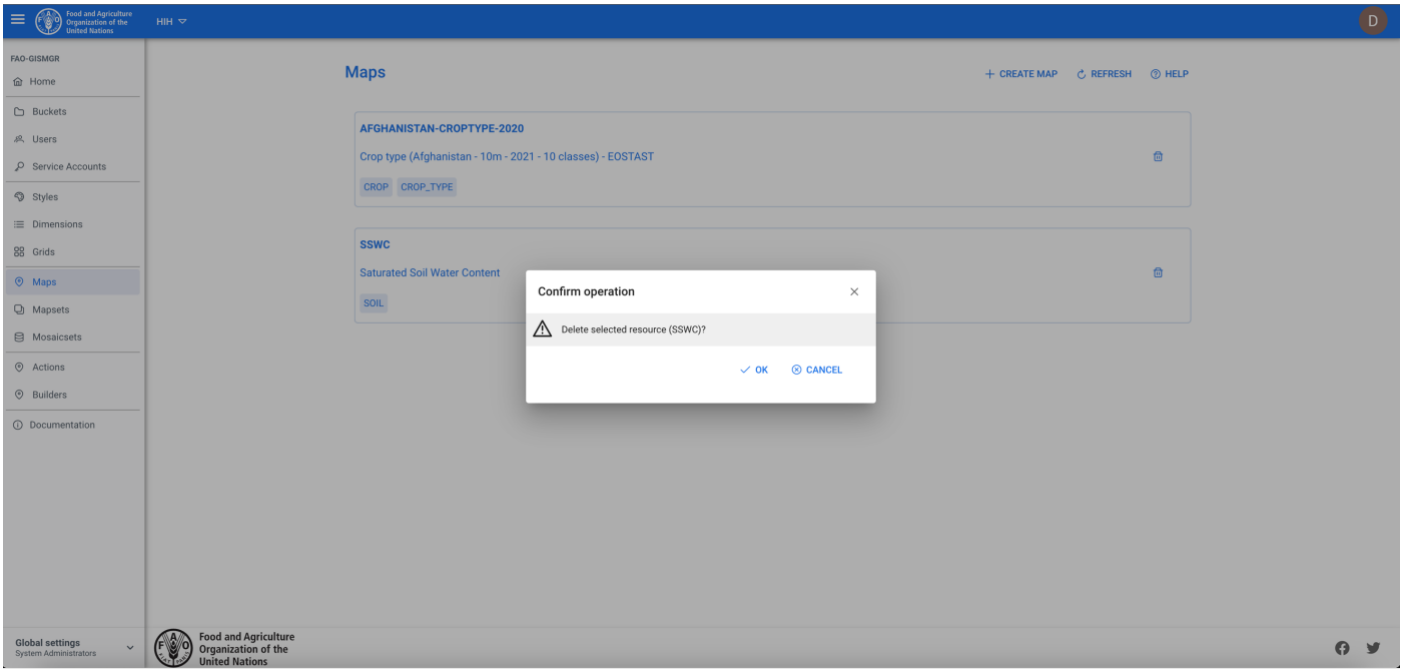

Figure 8 - Delete a resource.

2.6 Sign up

To sign up to FAO GISMGR 2.0 Web Application, the User must browse to the web application address (https://data.apps.fao.org/gismgr/web/v2/). The system will redirect to the sign up/ sign in window. The User must enter his email address: if the User is already registered, the system will prompt to enter the password; if not, the system will prompt to enter personal information, first and last name, and the password. After completing the registration, the User will be redirected to the Web Application.

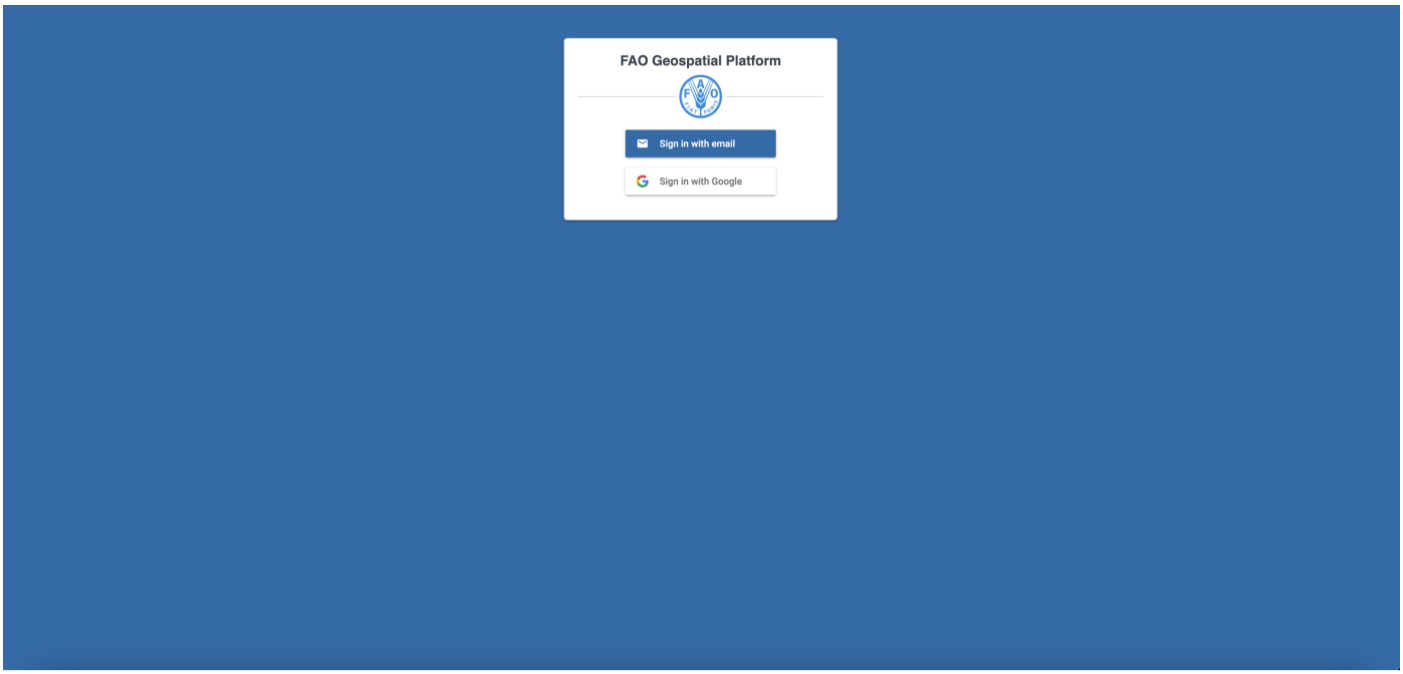

Figure 9 - Sign up, select email provider.

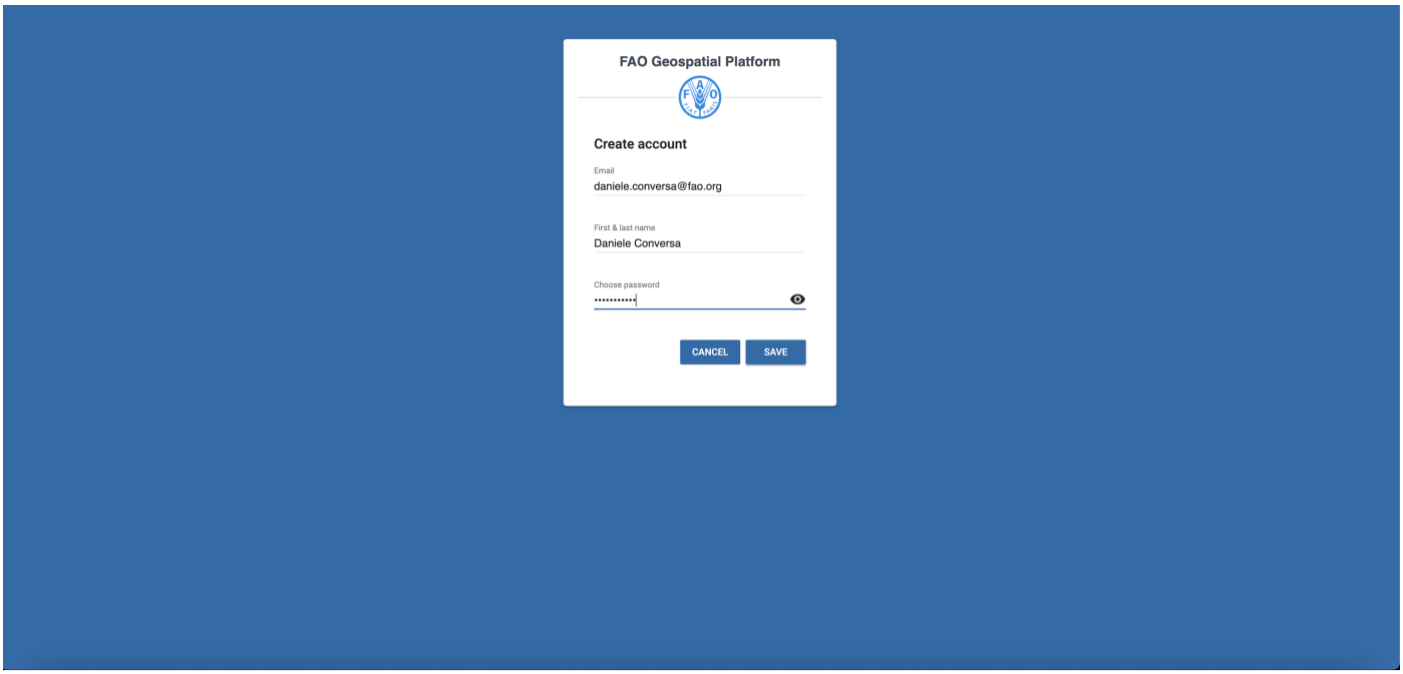

Figure 10 - Sign up, enter personal information

2.7 Sign in

To sign into FAO GISMGR 2.0 Web Application, the User must browse to the web application address (https://data.apps.fao.org/gismgr/web/v2/). The system will redirect to the sign up/ sign in window. The User must input email address and password. If the sign in is successful, the User will be redirected to the Web Application.

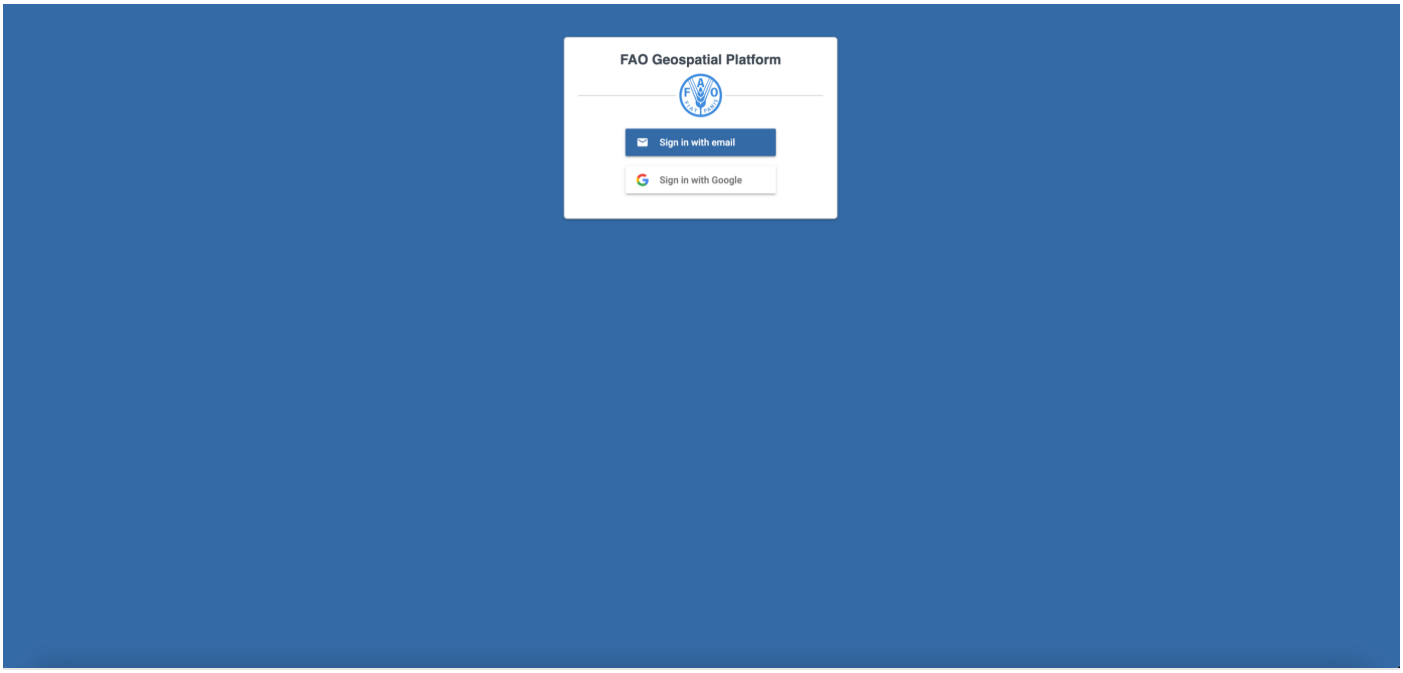

Figure 11 - Sign in

2.8 Sign out

To sign out from FAO GISMGR 2.0 Web Application, the User must click on the avatar at the top right of the window and select Sign out from the popup menu. The system will sign the User out and redirect him to the login page (https://data.apps.fao.org/gismgr/web/v2).

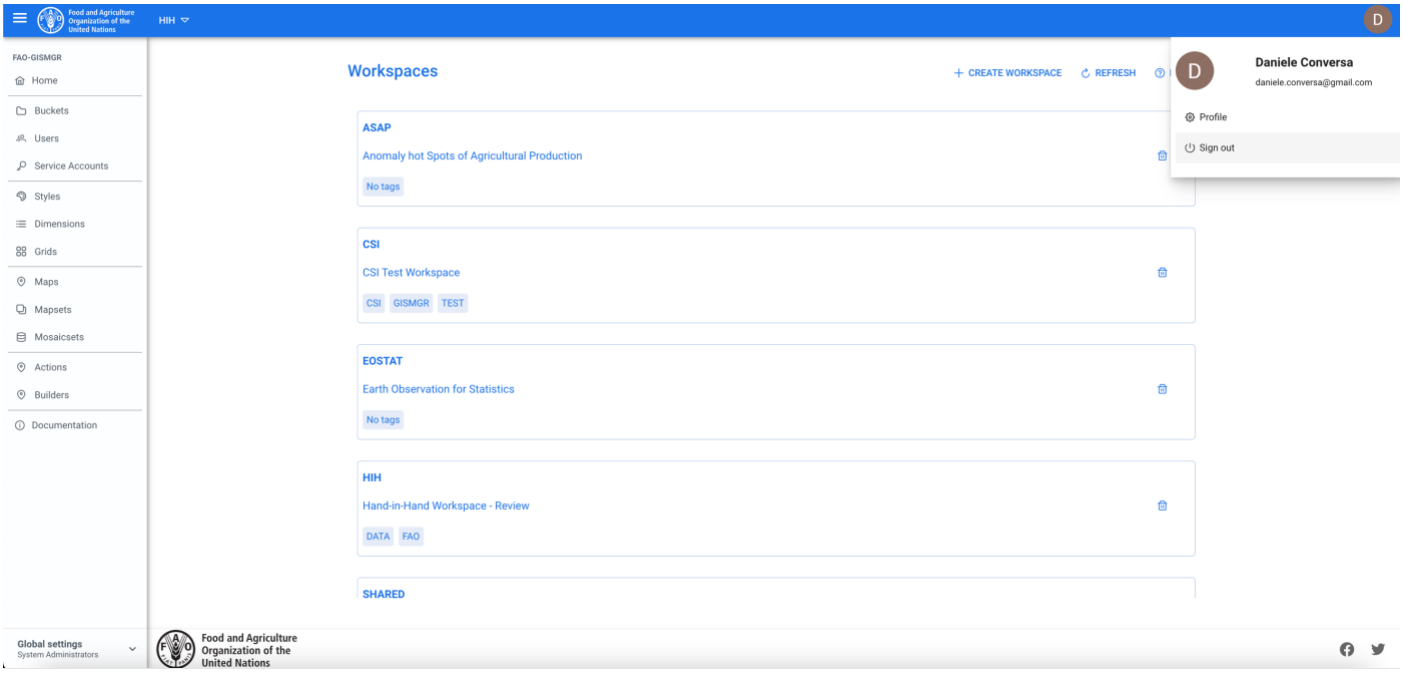

Figure 12 - Sign out.

3 Workspaces

A Workspace is a shared working environment to group and manage various resources and work with them as a cohesive unit promoting collaboration between multiple businesses or individuals. A Workspace has the following properties:

Workspace

FIELD	DESCRIPTION
code	`string`: unique identifier of the resource. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
caption	`string`: a title or brief explanation of the resource. cannot be null; length must be min=3 and max=128; all characters except line breaks are allowed.
description	`string`: full or long explanation of the resource. can be null or empty;
contacts	`array`: list of `contact` objects (see below); can be null or empty.
tags	`array`: list of `string` objects. can be null or empty; a **`tag`** is a keyword or term assigned to a piece of information to describe it.
additionalInfo	`object`: additional information about the resource. can be null; a freely structured JSON object provided by the data owner to better describe the resource

Contact

FIELD	DESCRIPTION
fullName	`string`: the full name of the person. cannot be null;
jobTitle	`string`: person's official designation in the company. it indicates the seniority level and roles and responsibilities in the organization. can be null.
department	`string`: division of a large organization such as a government, university, or business, dealing with a specific area of activity. can be null.
employer	`string`: individual or an organization in the government, private, nonprofit, or business sector for which the person works. can be null.
email	`string`: person’s valid email address. can be null.

phone	`string` : person's phone number can be null.

After signing into the Web Application, the system will display a list of workspaces. The User must select a Workspace to work on. In order to access a Workspace, the User must have been granted access from the workspace owners/administrators or from the system administrators.

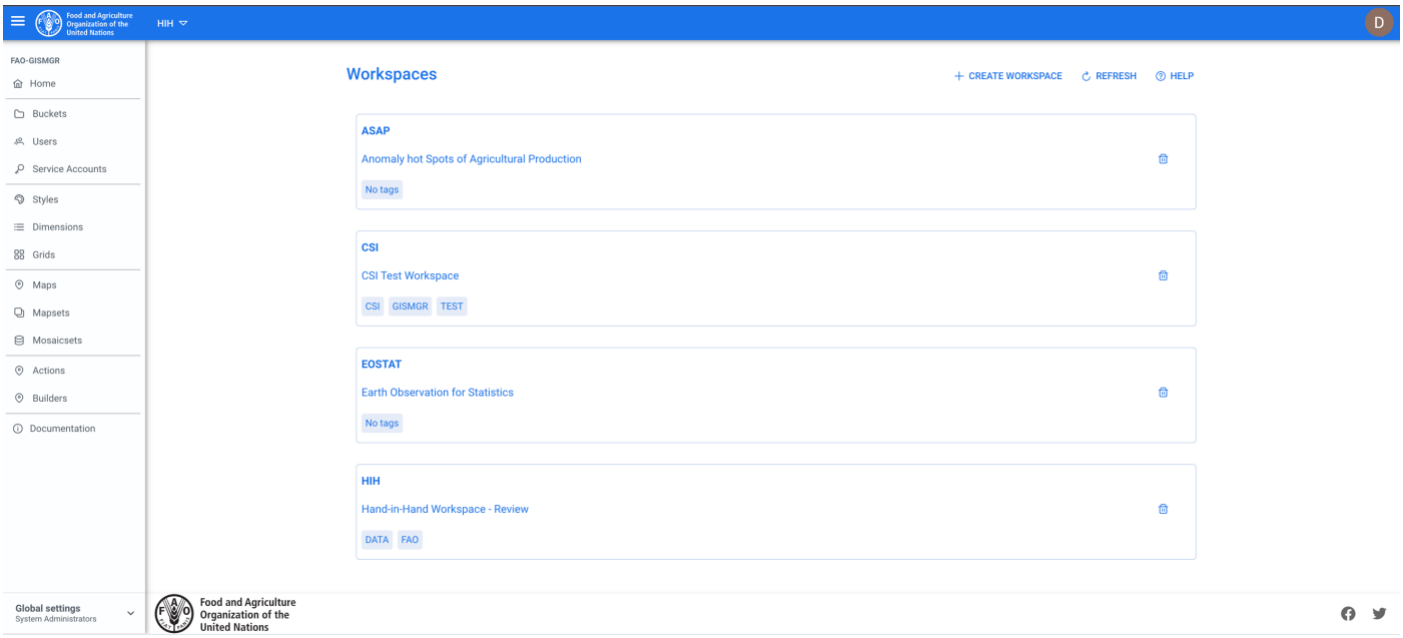

Figure 13 - Workspaces main page.

3.1 List all Workspaces

After signing into the Web Application, the system will display, by default, a list of the workspaces available. At any time, during navigation, to display a list of workspaces, the User can press the down-arrow on the top left part of the window, right after the FAO logo. This dropdown either displays a "Select workspace" prompt, if no Workspace has been selected, or the code of the selected Workspace.

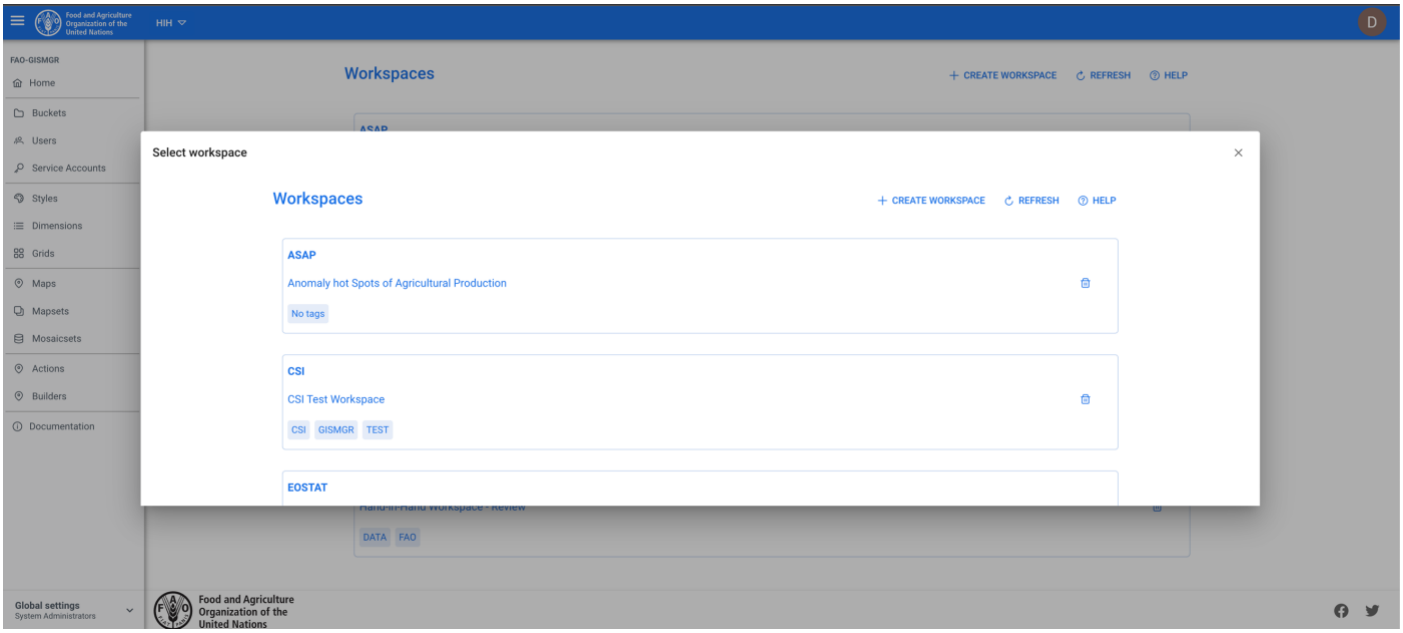

Figure 14 - List all Workspaces.

3.2 Create a new Workspace

To create a new Workspace, the User must press the “Create Workspace” button from the Workspace list and fill the fields, the required ones, code and caption, being marked with asterisk (*).

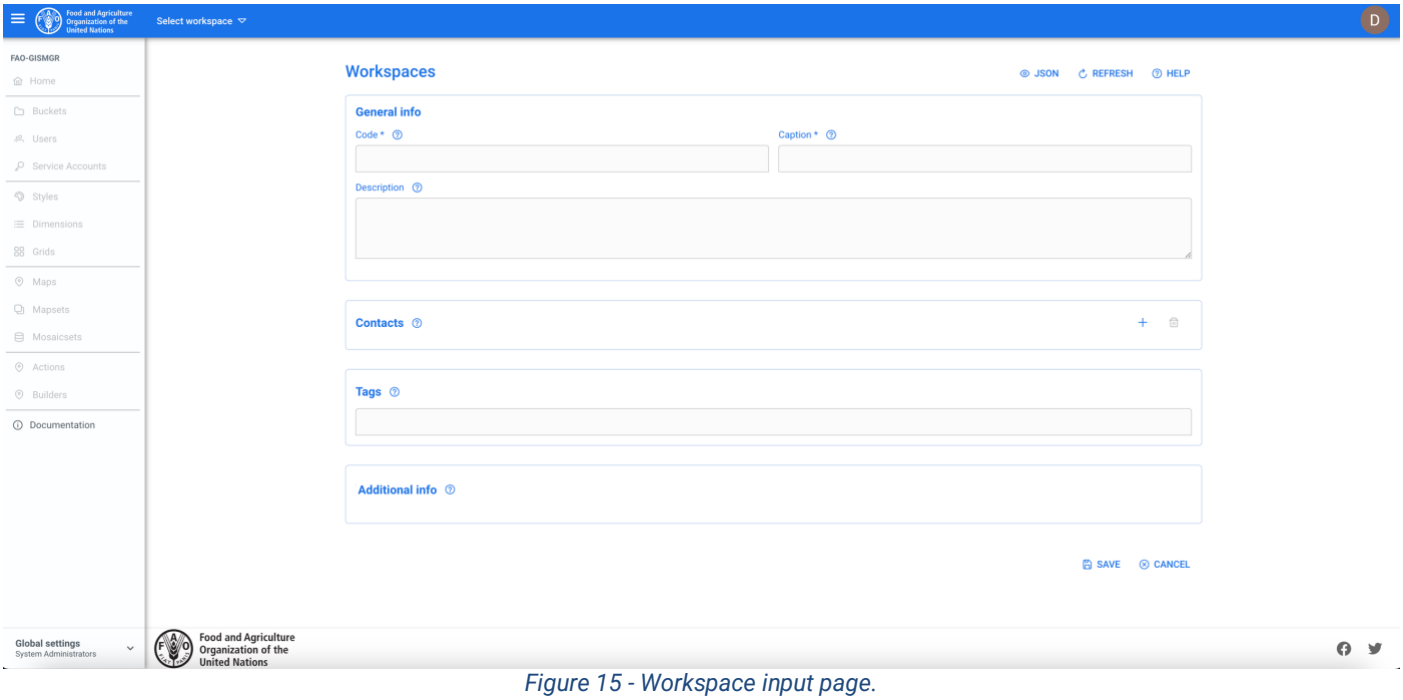

Figure 15 - Workspace input page.

To add a Contact (optional) the User must press the + button in the Contacts box. The system will display a Contact input form.

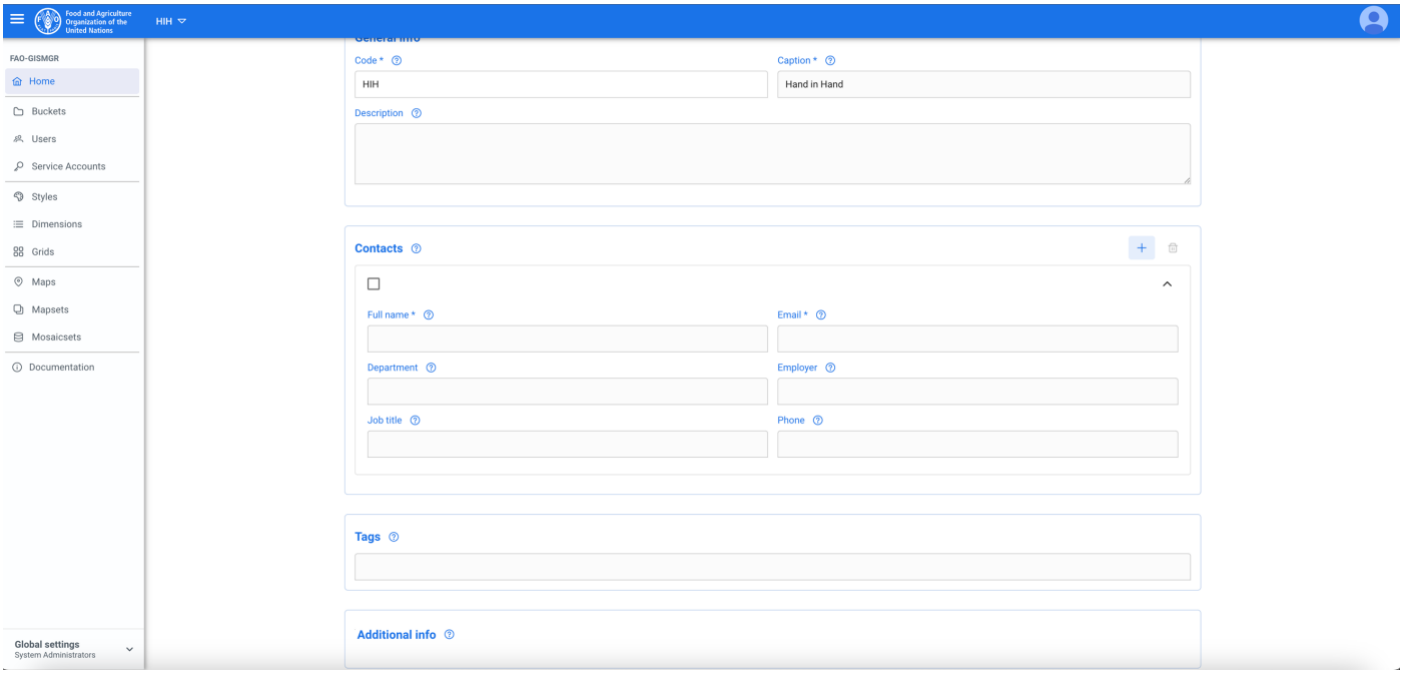

Figure 16 - Workspace, add a Contact.

To delete a Contact/s, the User must select the checkbox of the Contact/s to delete and then press the delete button (bin) on the top right of the Contact box.

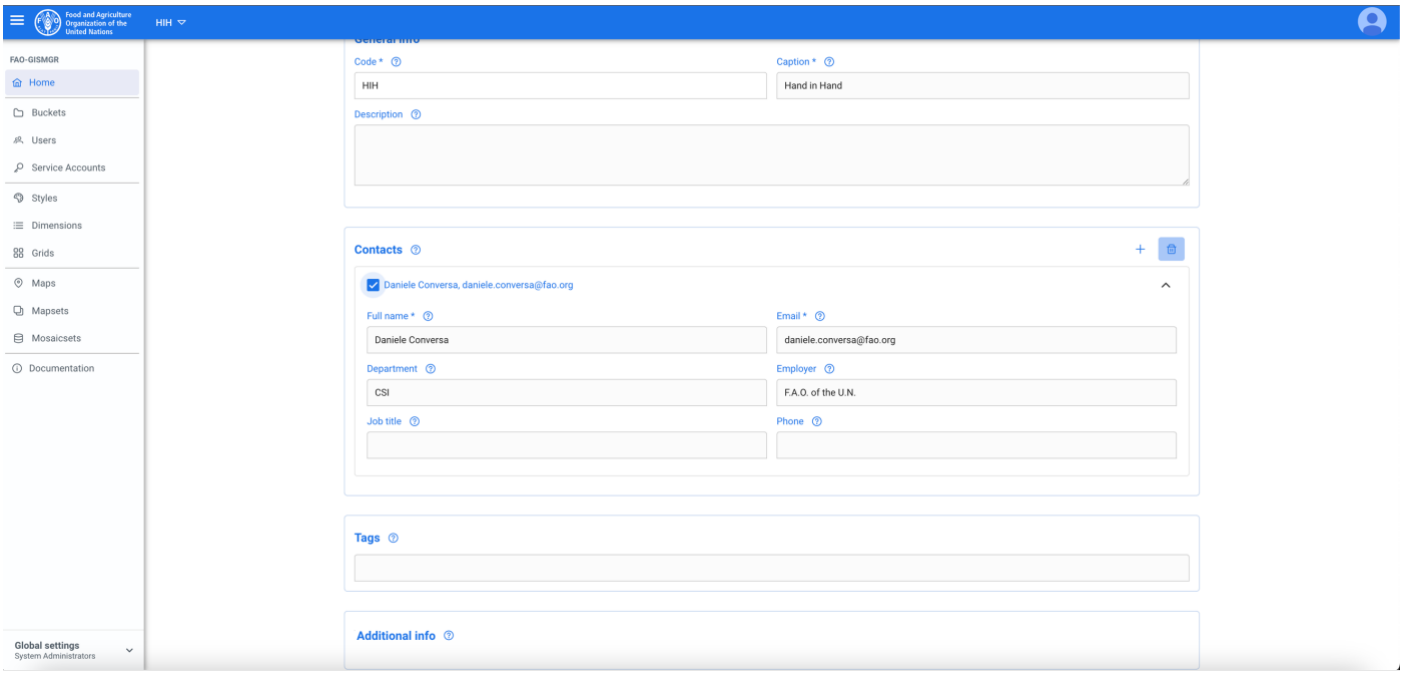

Figure 17 - Workspace, delete a Contact.

To add Additional Info, the User must press the + button on the top right of the Additional Info box. The system will display a popup from where the User can enter the name (*key*) of the property, the type and the value.

As far as type is concerned, the system manages, for the Additional Info, the following types:

- Integer
- Float
- String
- Map
- Array

After entering the input data, the User must press Add field button (or Update field in case of update). If the validation succeeds, the system will close the popup and display the information in the Additional Info box.

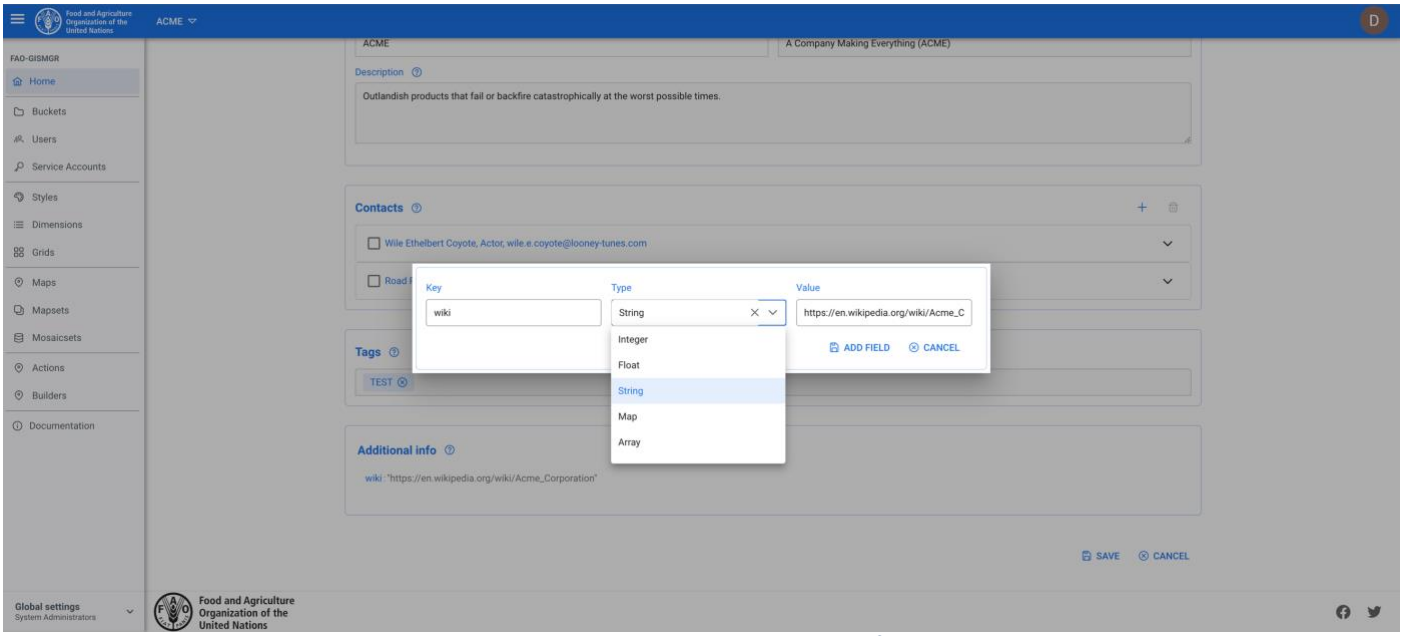

Figure 18 - Workspace Additional Info.

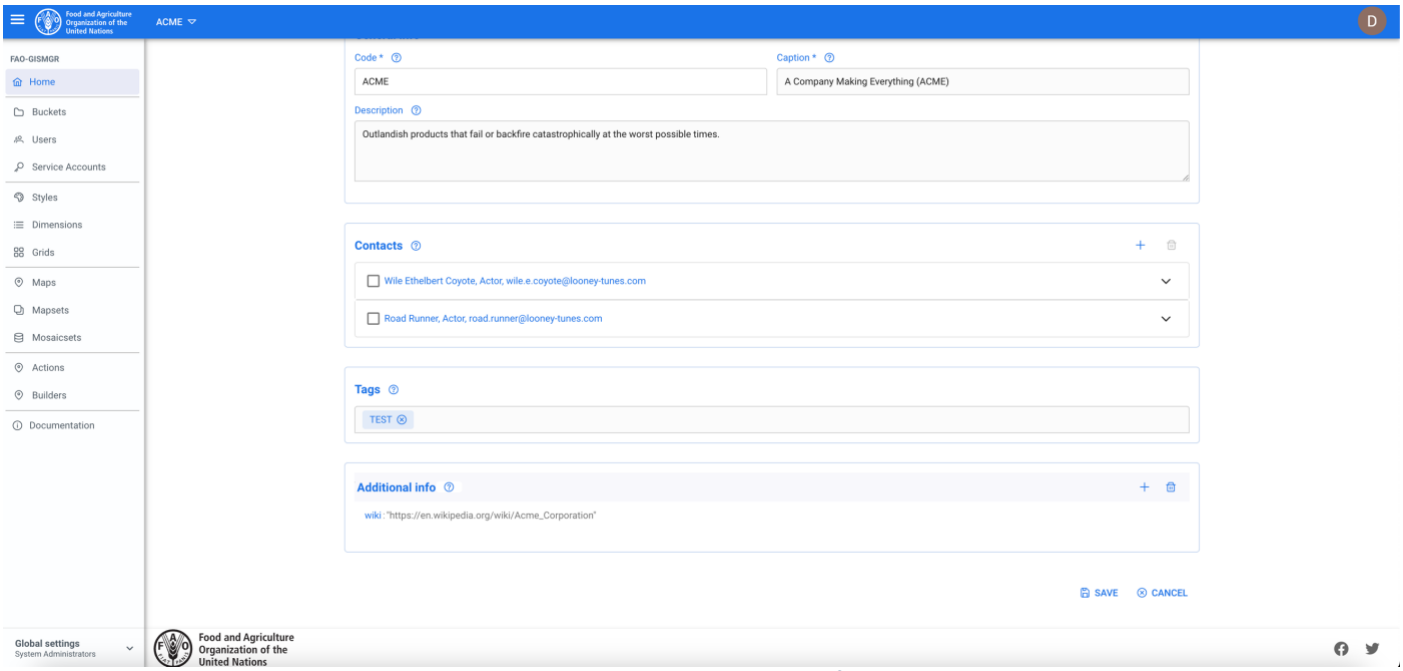

Figure 19 - Workspace Additional Info display.

To update or delete one of the fields of the Additional Info, the User must move over the field of interest with the mouse. The system will display an edit (pencil) and a delete (bin) button on the

right side of the property. Pressing the edit button will open the popup for editing the field, while pressing the delete button will remove the field.

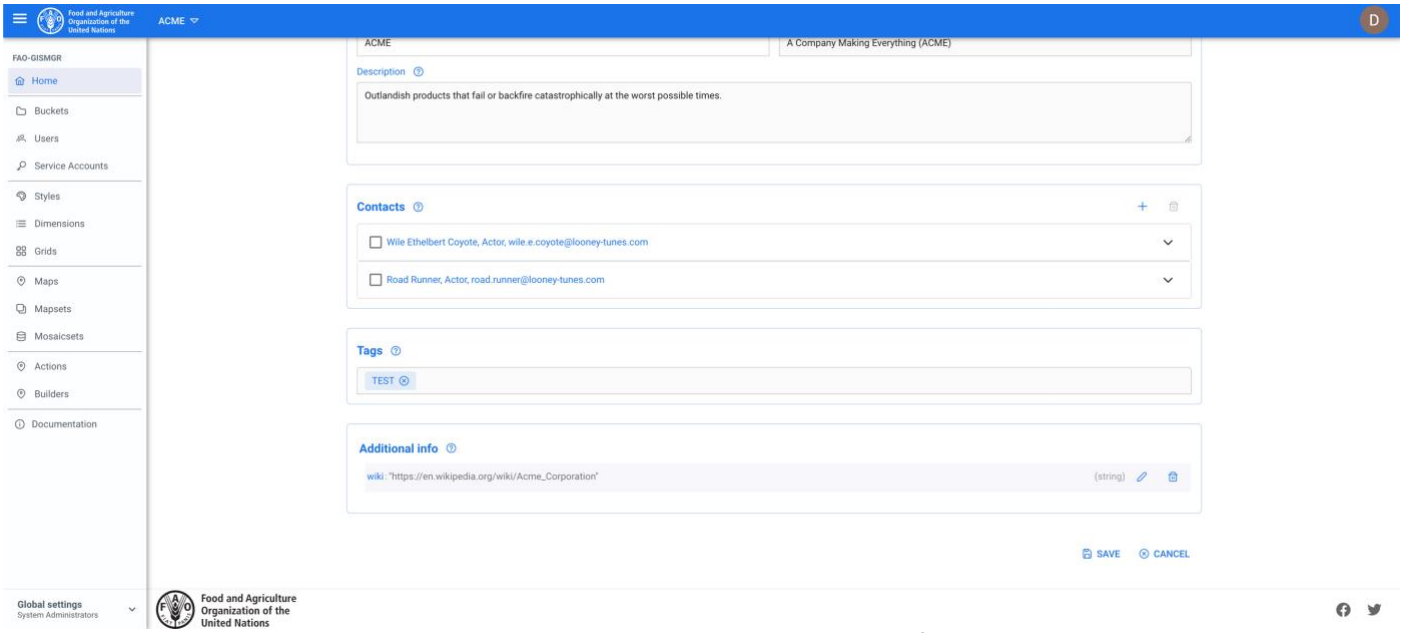

Figure 20 - Workspace, editing Additional Info

After filling the Workspace form, the User must click the Save button. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

3.3 Update a Workspace

To update a Workspace, the User must select an existing Workspace from the list of workspaces by clicking/tapping on the desired one. The system will display the selected Workspace input form to update the data. Once completed, the User must press the save button to save the changes. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

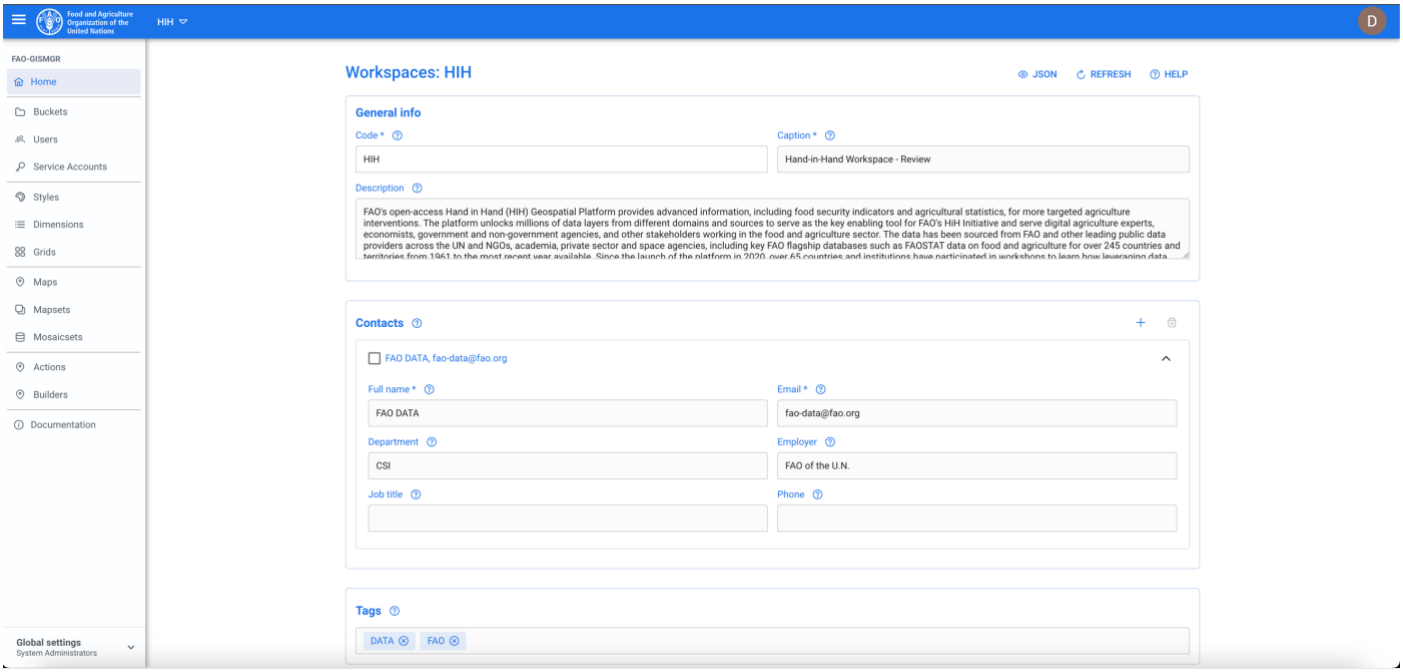

Figure 21 - Update a Workspace.

3.4 Delete a Workspace

To delete a Workspace, the User must browse to the Workspace list and press the Delete button (bin) relative to the chosen Workspace. The system will display the deletion confirmation popup message. The User must choose ok to confirm deletion or cancel to cancel the operation. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

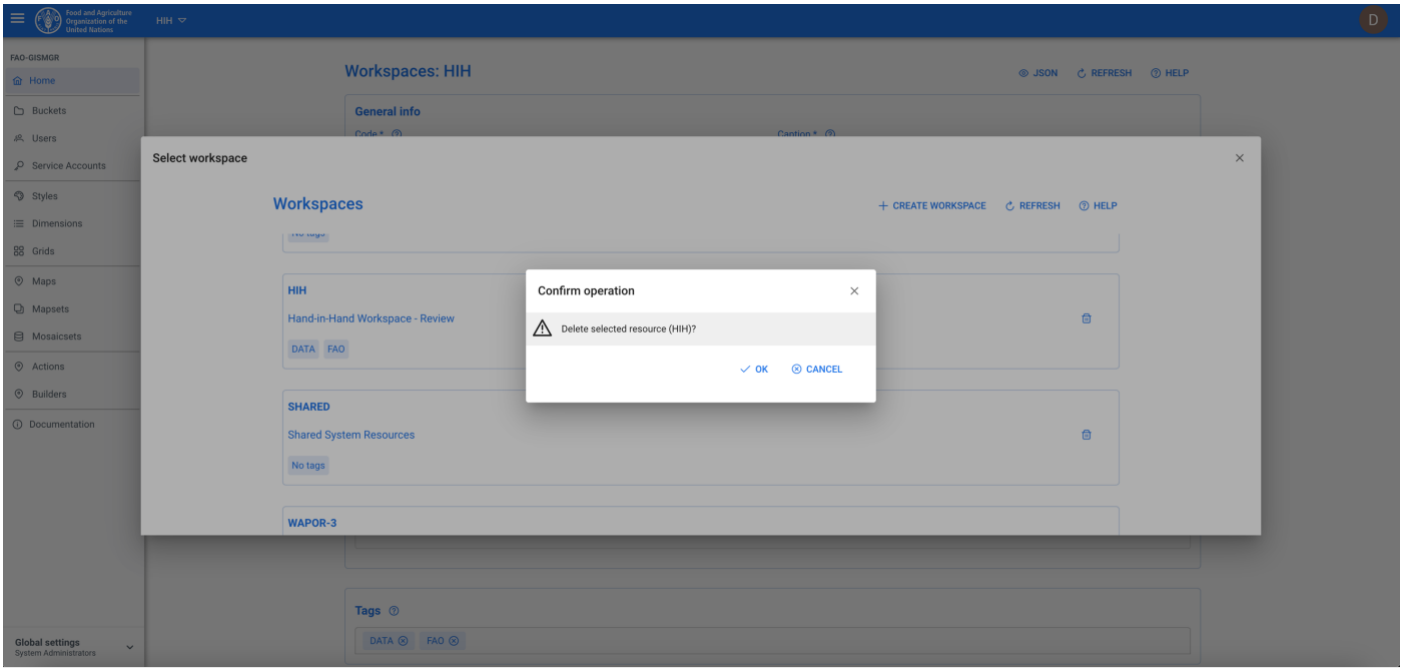

Figure 22 - Delete a Workspace.

4 Users

GISMGR manages resource access permissions using the concepts of Users and Roles. A User is identified by a valid and existing email address. A Role specifies which operations that user can perform on resources belonging to a specific workspace.

FIELD	DESCRIPTION
email	string : the email address that identifies the user. cannot be null; must be a valid and existing email address.
role	string : the role assigned to the user within the selected workspace cannot be null; allowed values are: • ADMIN • EDITOR • DATA_MANAGER • DATA_UPLOADER • DATA_VIEWER

4.1 User roles

FAO GISMGR 2.0 web application has the following roles:

ROLE	DESCRIPTION
ADMIN	• can perform READ/WRITE operations on all workspace resources except managing ADMIN members. • can list/read/download data stored on the workspace's DATA bucket. • can list/read/download and store data on the workspace's UPLOAD bucket. • only System Administrators can create, update or delete workspace ADMINs.
EDITOR	• can perform READ/WRITE operations on all workspace resources except managing users and changing DATA bucket accessibility. • can list/read/download data stored on the workspace's DATA bucket. • can list/read/download and store data on the workspace's UPLOAD bucket
DATA_MANAGER	• can list/read/download data stored on the workspace's DATA bucket. • can list/read/download and store data on the workspace's UPLOAD bucket.
DATA_UPLOADER	• can list/read/download and store data on the workspace's UPLOAD bucket.
DATA_VIEWER	• can list/read/download data stored on the workspace's DATA bucket.

4.2 List all Users

To list all Users, after selecting a Workspace, the User must click the Users button from the left menu. The system will display all Users in the system, for the selected Workspace, and their respective role.

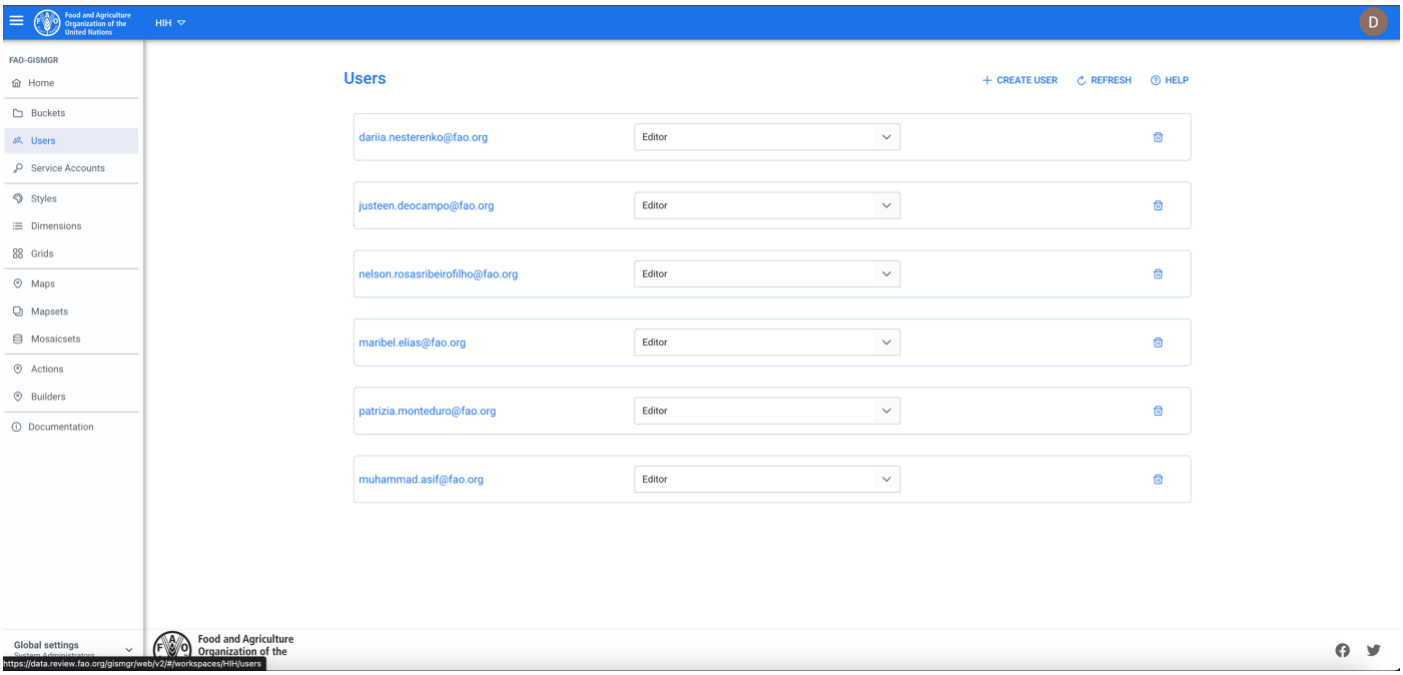

Figure 23 - Listing Users.

4.3 Create a new User

To create a new User, after selecting a Workspace, the User must browse to the Users page from the main menu. The system will display a list of the existing users. The User must press the Create User button on the top right of the page. The system will display a popup: the User must enter the email and the Role for the new User being created and press the save button.

If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

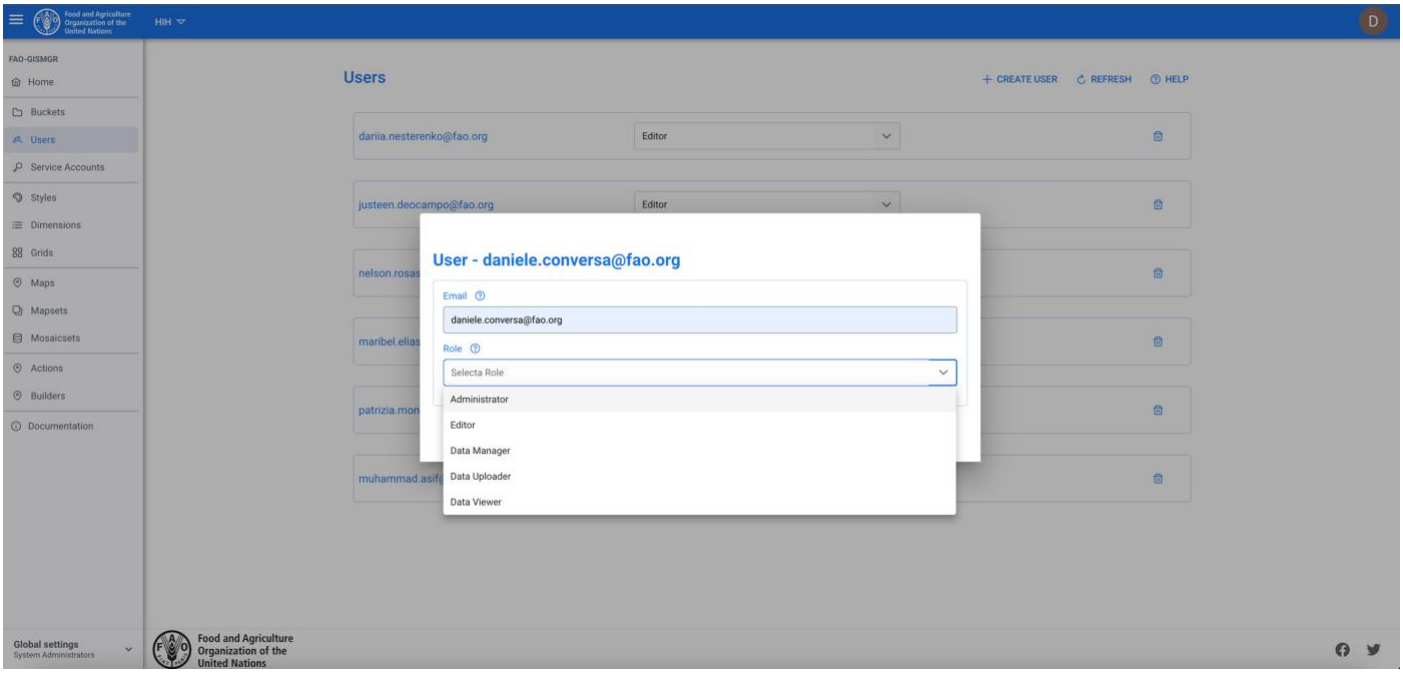

Figure 24 - Create a new User.

4.4 Update a User

To update a User's role, the User must press the Users button from the left menu. In the list, the User must select the desired Role from the dropdown at the side of every User present in the list. After changing the role, the system will update the User with the new role.

If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

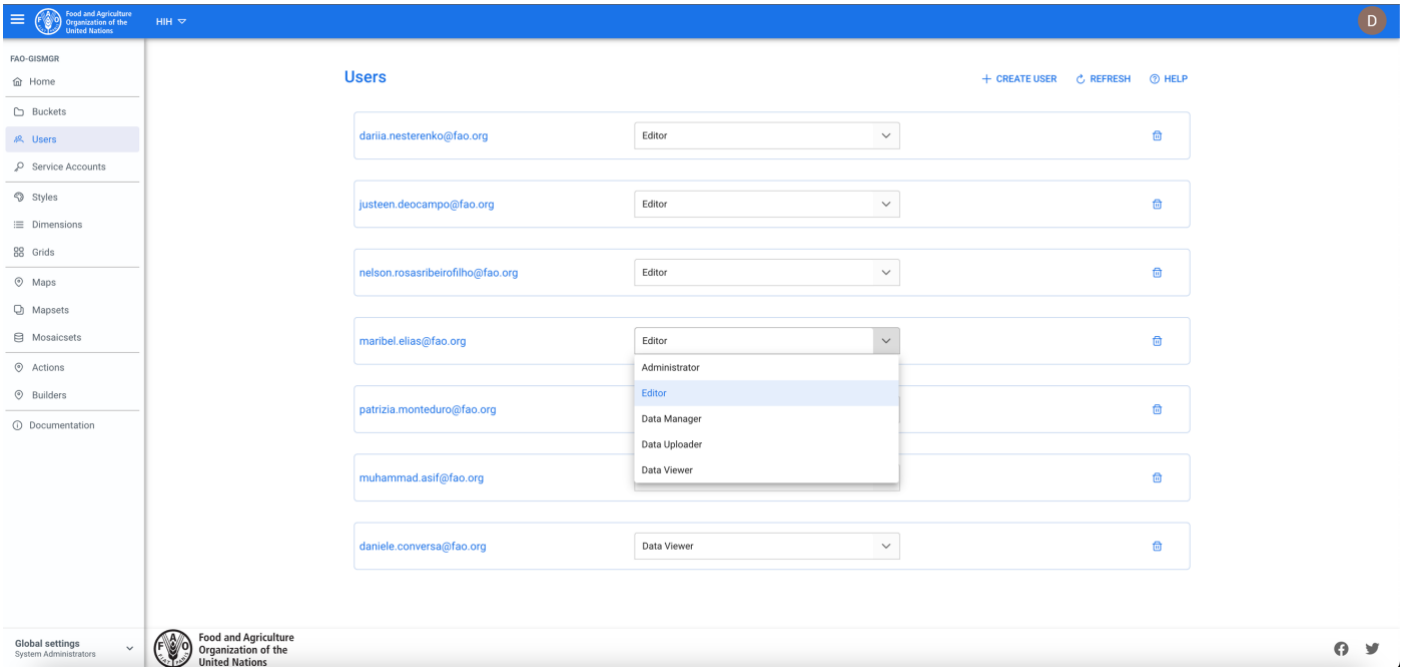

Figure 25 - Update a User.

4.5 Delete a User

To delete a User, the User must press the Users button from the left menu. The system will display the list of all Users for the selected Workspace. To delete a User, the User must press the corresponding delete button. The system will display the deletion confirmation popup message. the User must choose ok to confirm deletion or cancel to cancel the operation. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

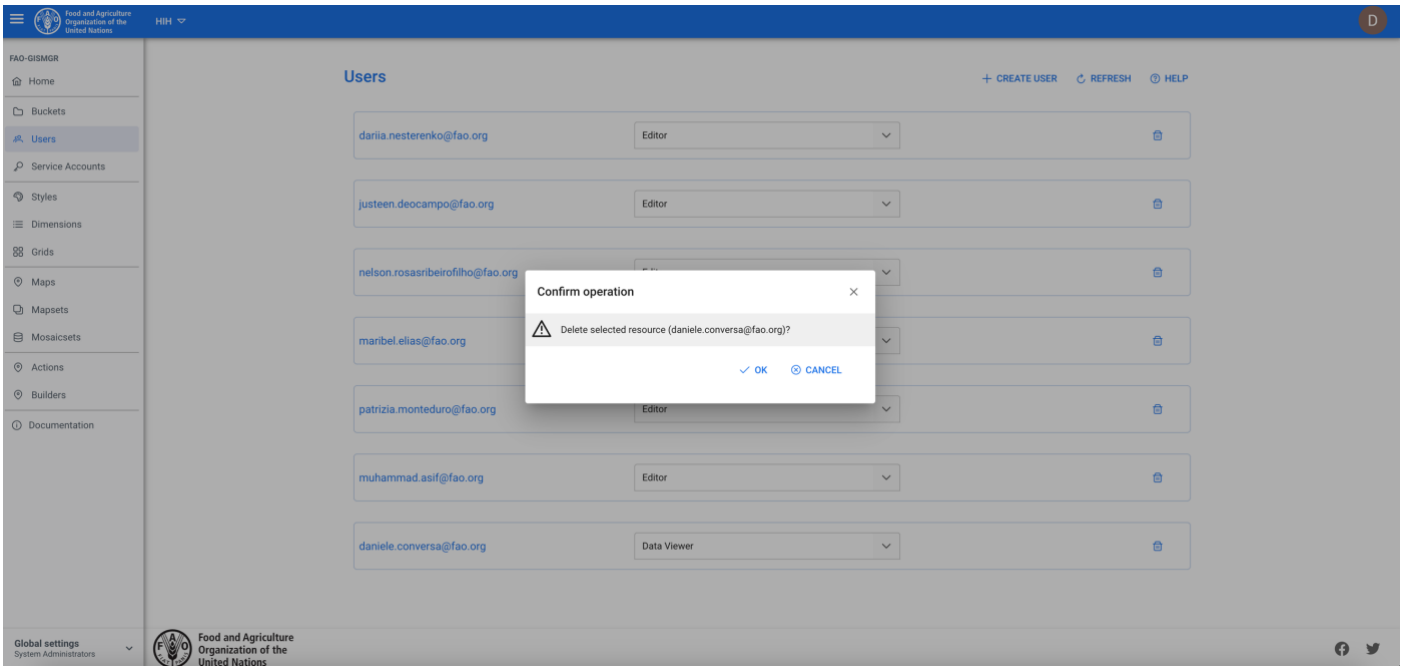

Figure 26 - Delete a User.

5 Buckets

For every workspace the system automatically creates 2 buckets, the “UPLOAD” bucket and the “DATA” bucket.

NAME	DESCRIPTION
UPLOAD	used to ingest/import workspace’s data into the system. data can be uploaded manually, using the Google Cloud Platform console, or programmatically using provided or custom tools. All the predefined roles, except the DATA_VIEWER one, can list/read/download and upload data.
DATA	used to store the processed final data and related metadata files. data can be uploaded only by the system, while list/read/download operations are allowed depending on the accessibility level type set on the bucket (see below).

To access the buckets page, the User must click the Buckets button from the left menu. The system will display the two buckets, the Upload and the Data bucket.

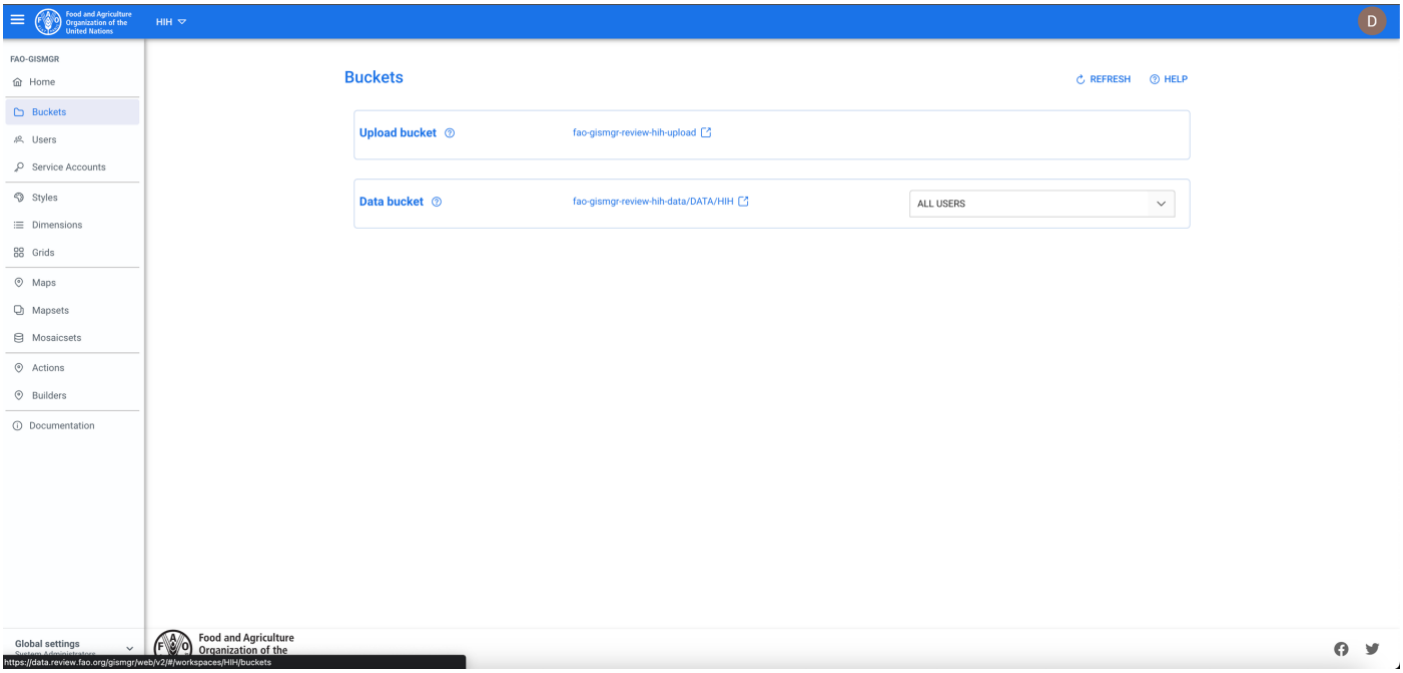

Figure 27 - Buckets.

5.1 Upload bucket

In the buckets page, the system will display the name and the link to the Upload bucket where authorized users can upload data. By clicking the link, the User will be redirected, on a new window, to the Google Cloud Storage Bucket.

The Upload bucket has a structure of folders that matches the resource types managed by the system (having a folder for every resource type):

- GRID
- MAP
- MAPSET
- MOSAIC
- MOSAICSET

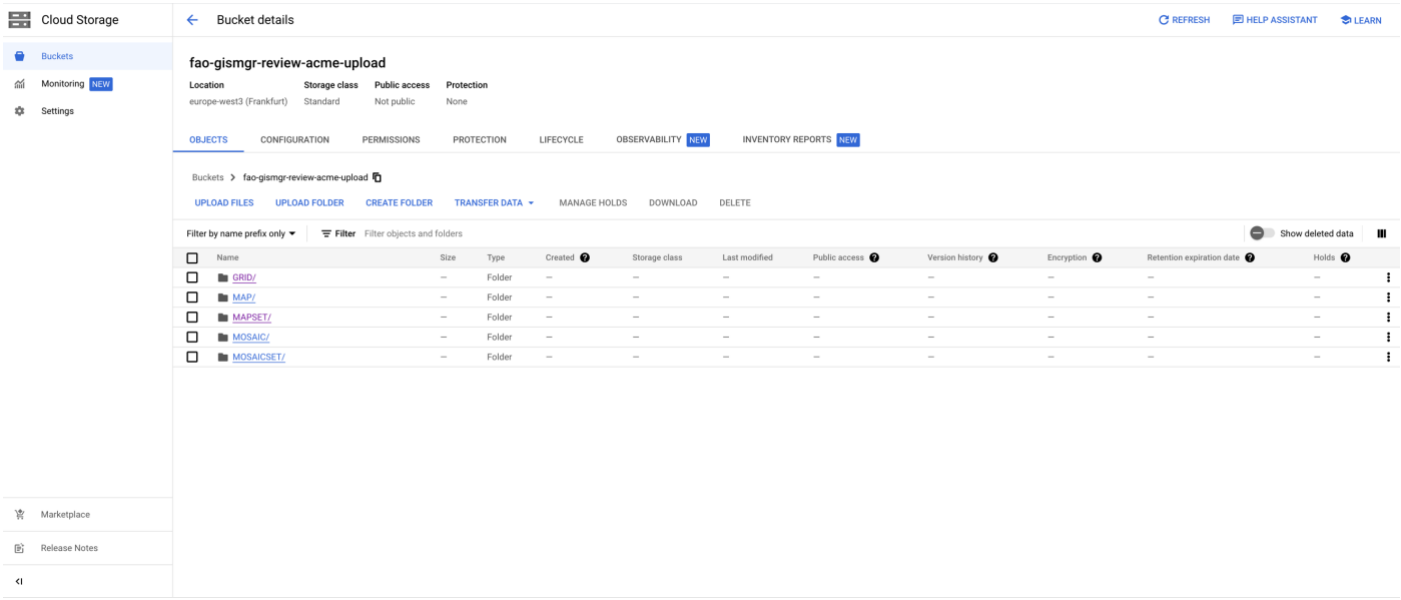

Figure 28 - Upload bucket structure

Under every “resource type” folder, the system creates a specific folder using the code of every resource created for the specific type. If a User creates a Mapset with the code *“PHENOLOGY”* in the Workspace *“ACME”*, the path in the upload bucket would be *“fao-gismgr-acme-upload/MAPSET/PHENOLOGY/”*.

5.2 Data bucket accessibility

In the buckets page, the system will display the name and the link to the Data bucket where authorized users can view and download data. By clicking the link, the User will be redirected to the Google Cloud Storage Bucket. Authorized users can change the access level of the data bucket according to the following table:

TYPE	DESCRIPTION
ALL USERS	all objects stored on the bucket are readable to anyone who is on the internet, including authenticated and unauthenticated users (anonymous visitors).
AUTHENTICATED USERS	all objects stored on the bucket are readable to all service accounts and all users on the internet who have authenticated with a Google Account. This includes accounts that aren't connected to a Google Workspace account or Cloud Identity domain, such as personal Gmail accounts. Users who aren't authenticated, such as anonymous visitors, aren't included.
NOT PUBLIC	all objects stored on the bucket are readable to all service accounts and all users on the internet who have authenticated with a Google Account and have been granted with one of the predefined workspace roles except the DATA_UPLOADER one.

To change the Data bucket access level, the User must select the desired option from the corresponding dropdown. The system will update the bucket access level. If the operation is

completed successfully the system will display a confirmation message, otherwise it will display the error message.

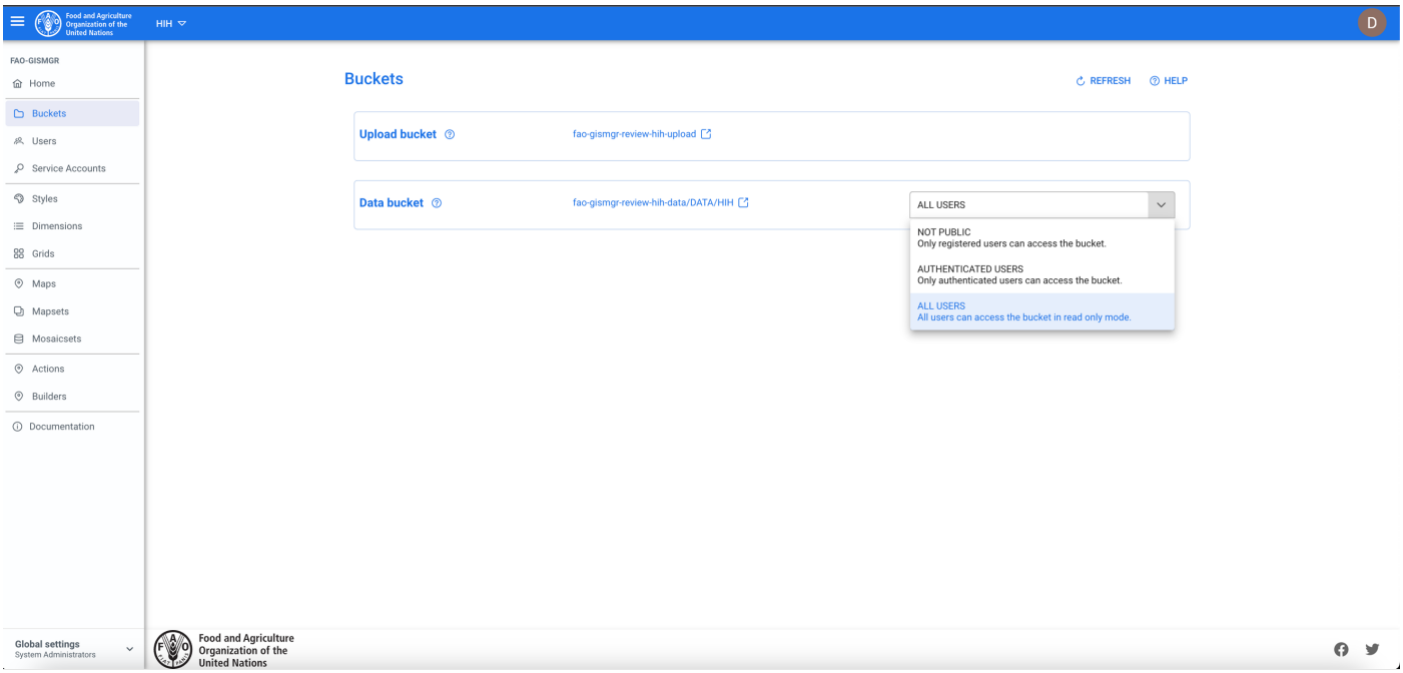

Figure 29 - Data bucket access level.

The Data bucket has a slightly different structure from the Upload bucket. It has a root folder called “DATA”, followed by a folder with the code of the Workspace (“ACME” following the previous example) and then the following folders matching the resource type:

- DIMENSION
- GRID
- MAP
  MAPSET
- MOSAIC
- MOSAICSET
- STYLE

For every resource, including the Workspace, the system creates a JSON file with the resource metadata.

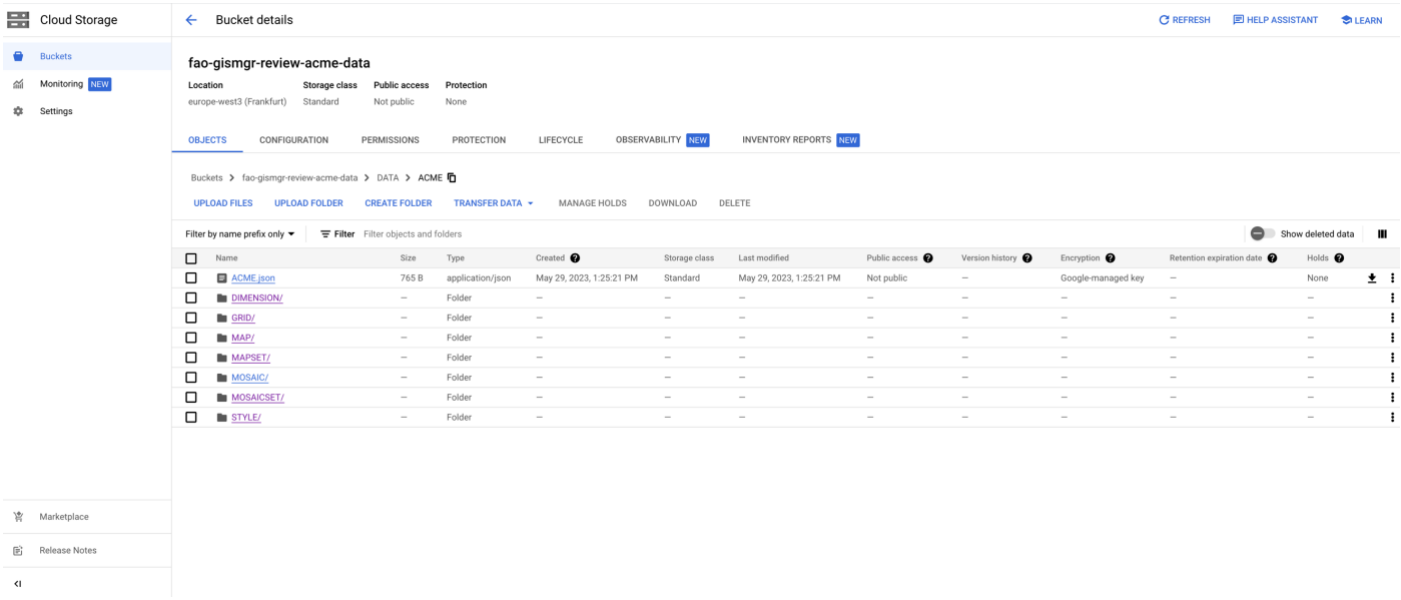

Figure 30 - Data bucket structure

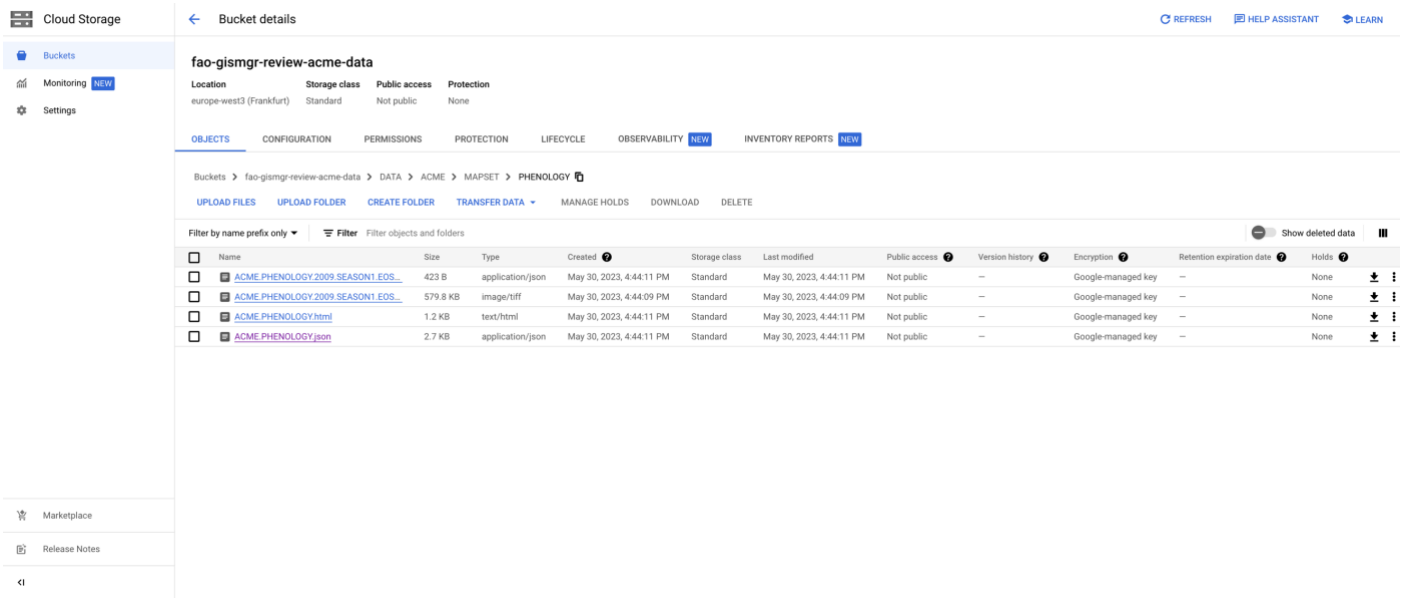

Figure 31 - Data bucket structure, Mapset example

6 Styles

Geospatial data has no intrinsic visual component. In order to visualize data, data must be styled. Styling specifies color, opacity, and other visible attributes used to render data on a map. Below a table with the fields used to define a Style and its components, a Color Map and a Color item.

Style

FIELD	DESCRIPTION
workspaceCode	string : unique code of the workspace to which the resource belongs. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
code	string : unique identifier of the resource. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
caption	string : a title or brief explanation of the resource. cannot be null; length must be min=3 and max=128; all characters except line breaks are allowed.
description	string : full or long explanation of the resource. can be null or empty;
colorMap	ColorMap : defines the color values for the pixels of a raster image, as either color gradients, or a mapping of specific values to fixed colors.

Color map

FIELD	DESCRIPTION
type	string : specifies the kind of ColorMap to use. cannot be null; there are three different types of ColorMap that can be specified: • INTERPOLATED is the default ColorMap type. It specifies that colors should be interpolated for values between the color map entries. • INTERVALS specifies that each interval defined by two entries is rendered using the color of the first (lowest-value) entry. No color interpolation is applied across the intervals. • VALUES specifies that only pixels with the selected entry quantity values are rendered. Pixels with other values are not rendered.
items	array : list of ColorMapItem objects that defines the ColorMap entries cannot be null nor empty;

Color Map Item

FIELD	DESCRIPTION

color	string : specifies the color that must be applied to the pixel. cannot be null; value is denoted in standard hexadecimal RGB format (#RRGGBB).
quantity	string : specifies the value of raster pixel; cannot be null;
opacity	string : specifies the transparency that must be applied to the pixel. can be null; min value=0.0; max value=1.0; default=1.0
label	string : is used to provide text for graphical legends; can be null or empty

6.1 List all Styles

To list all Styles, after selecting a Workspace, the User must click the Styles button from the left menu. The system will display all Styles in the system, for the selected Workspace.

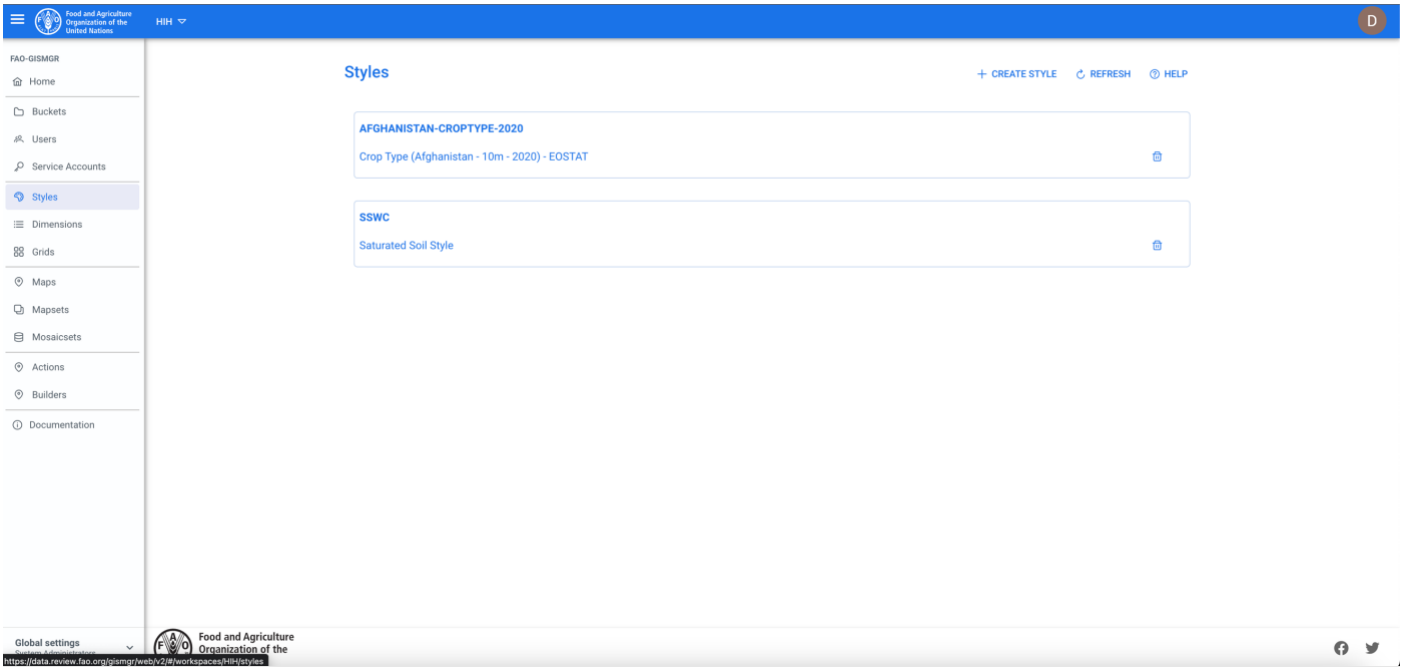

Figure 32 - List of Styles.

6.2 Create a Style

To create a new Style, after selecting a Workspace, the User must browse to the Styles page from the main menu. The system will display a list of the existing styles. To create a new Style, the User must press the Create Style button on the top right of the page and fill in the fields, the required ones being marked by an asterisk (*) and press the save button. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

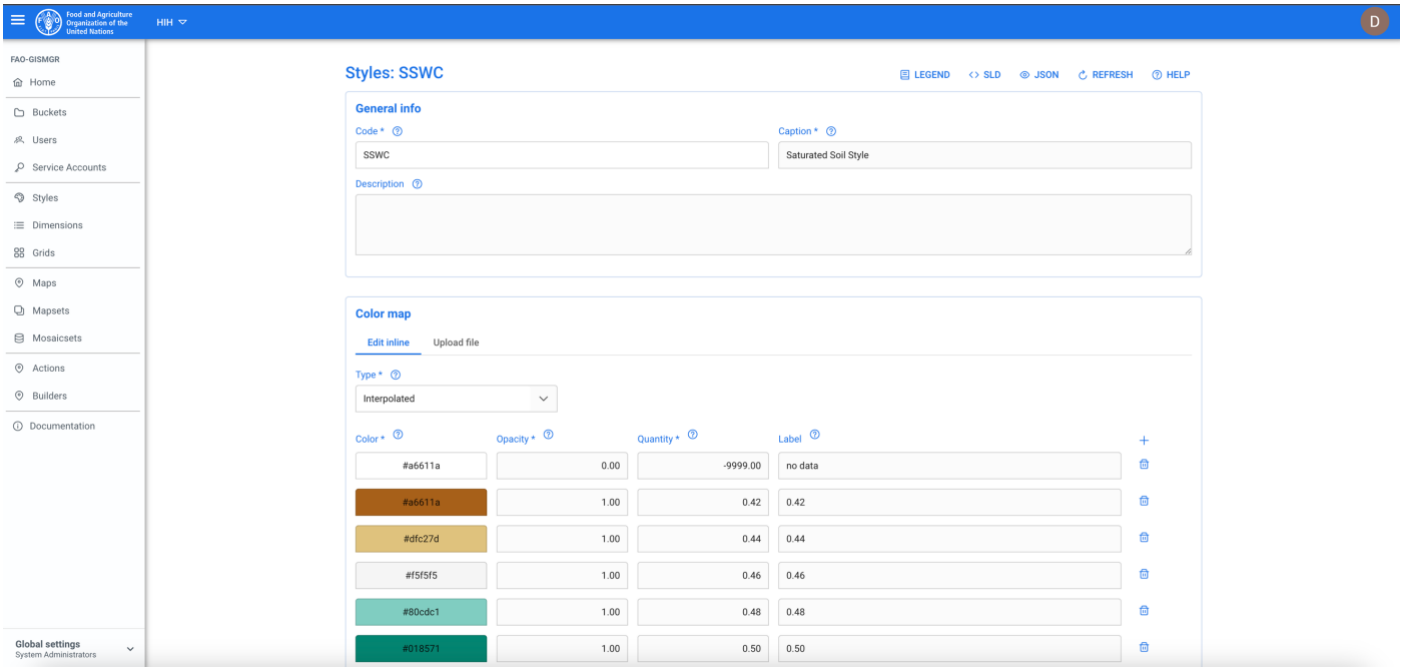

Figure 33 - Create a Style.

6.3 Create a Style using an SLD file

After filling the General Info part of the form, it is possible to upload an .SLD file to define the color map instead of filling all the form values.

STYLE SLD representation

```
<?xml version="1.0" encoding="UTF-8"?>
<StyledLayerDescriptor xmlns="http://www.opengis.net/sld"
                       xmlns:gml="http://www.opengis.net/gml"
                       xmlns:ogc="http://www.opengis.net/ogc"
                       xmlns:sld="http://www.opengis.net/sld"
                       version="1.0.0">
  <UserLayer>
    <sld:LayerFeatureConstraints>
      <sld:FeatureTypeConstraint/>
    </sld:LayerFeatureConstraints>
    <sld:UserStyle>
      <sld:Name>CRTB_AC-I</sld:Name>
      <sld:Title>Adaptive Capacity</sld:Title>
      <sld:FeatureTypeStyle>
        <sld:Rule>
          <sld:RasterSymbolizer>
            <sld:ColorMap type="values">
              <sld:ColorMapEntry color="#777777" opacity="0.0" quantity="-9999.0" label="nodata"/>
              <sld:ColorMapEntry color="#16400b" opacity="1.0" quantity="-1.0" label="Yes"/>
              <sld:ColorMapEntry color="#ffffff" opacity="0.0" quantity="0.0" label="No"/>
            </sld:ColorMap>
          </sld:RasterSymbolizer>
        </sld:Rule>
```

```
      </sld:FeatureTypeStyle>
    </sld:UserStyle>
  </UserLayer>
</StyledLayerDescriptor>
```

Click the Upload file tab and then the Select a file button. The system will open a window to choose a file from the file system. The User must select a valid SLD file and press the ok/open button; the popup will close. From the main Style window, the User must press the save button.

If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message. It is now possible to see the color map loaded from the file also in the main form.

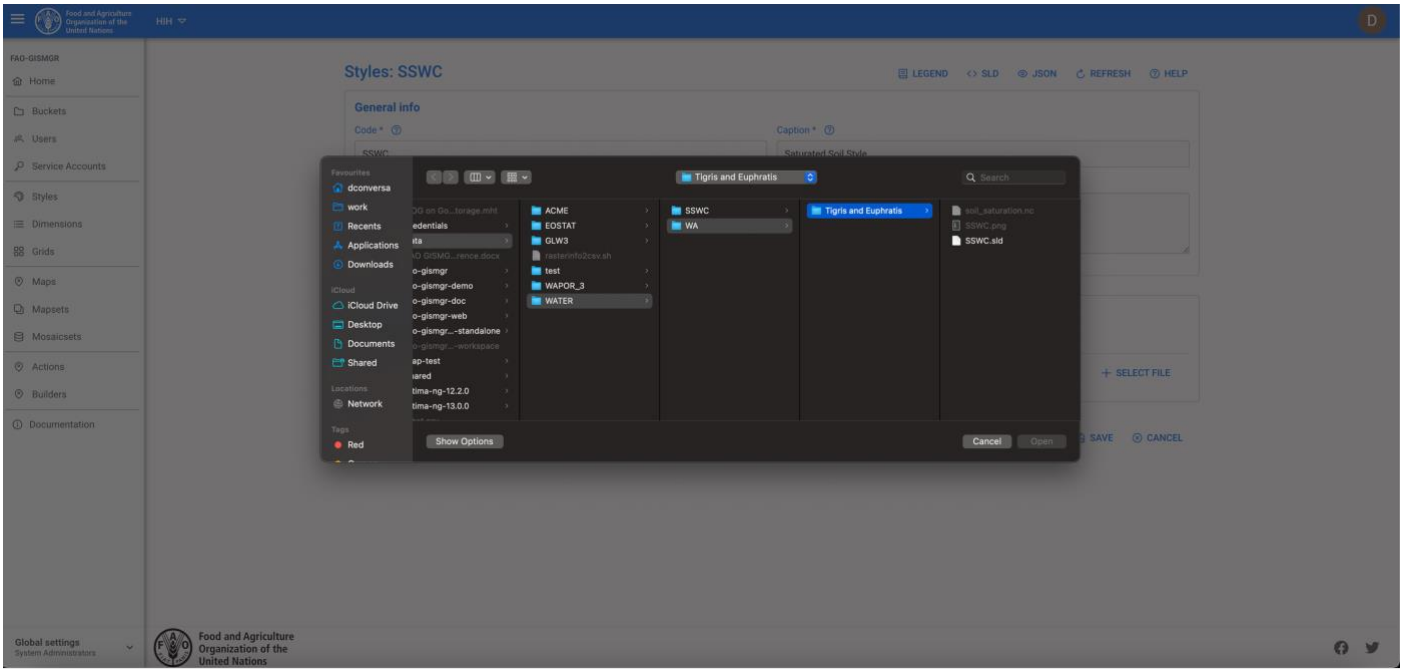

Figure 34 - Create a Style from an SLD file.

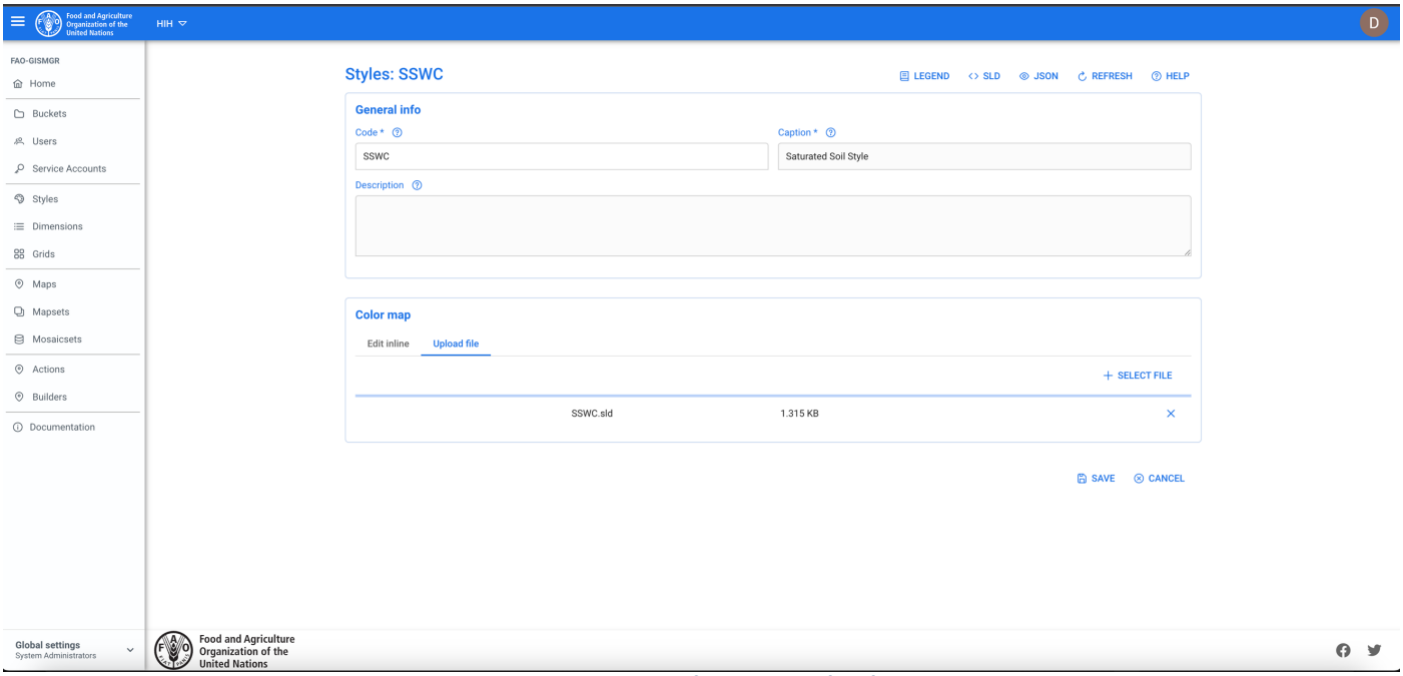

Figure 35 - Create a Style from an SLD file, file upload.

6.4 Create a Style using a JSON file

After filling the General Info part of the form, it is possible to upload a JSON file to define the color map instead of filling all the form values.

`ColorMap` JSON representation

```
{
    "type": "VALUES",
    "items": [
        {
            "quantity": -9999,
            "color": "#777777",
            "opacity": 0,
            "label": "no data"
        },
        {
            "color": "#16400b",
            "quantity": -1,
            "opacity": 1,
            "label": "Yes"
        },
        {
            "color": "#ffffff",
            "quantity": 0,
            "opacity": 0,
            "label": "No"
        }
    ]
```

```
}
```

The User must click the Upload file tab and then the Select a file button. The system will open a window to choose a file from the file system. The User must select a valid JSON file and press the ok/open button; the popup will close. From the main Style window, the User must press the save button. If the operation is completed successfully, the system will display a confirmation message, otherwise it will display the error message. It is now possible to see the color map loaded from the file also in the main form.

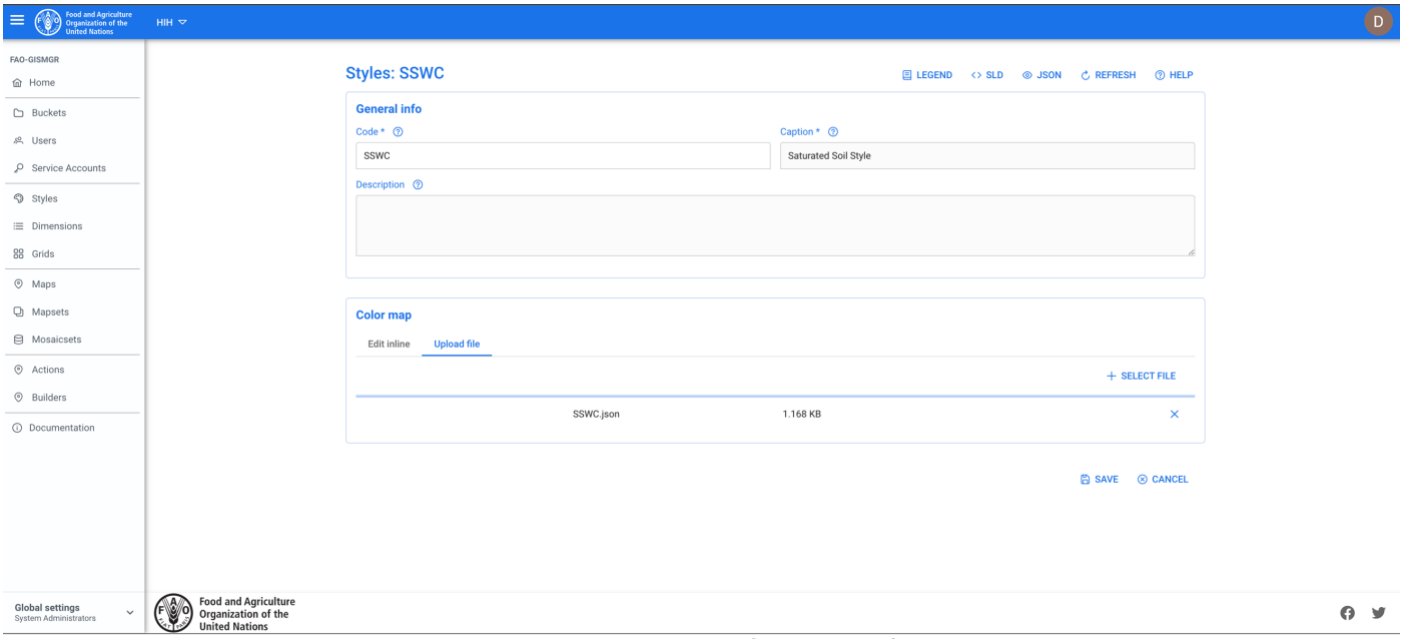

Figure 36 - Create a Style from a JSON file.

6.5 View a Style

To view a new Style, after selecting a Workspace, the User must browse to the Styles page from the main menu. The system will display a list of the existing styles. The User must click on the desired style. The system will display a page with the data relative to the style. It is also possible to view a style in the following formats: JSON, SLD, PNG.

6.5.1 View a Style - JSON

To view the JSON representation of a Style, the User must press the JSON button on the top right of the Style view page.

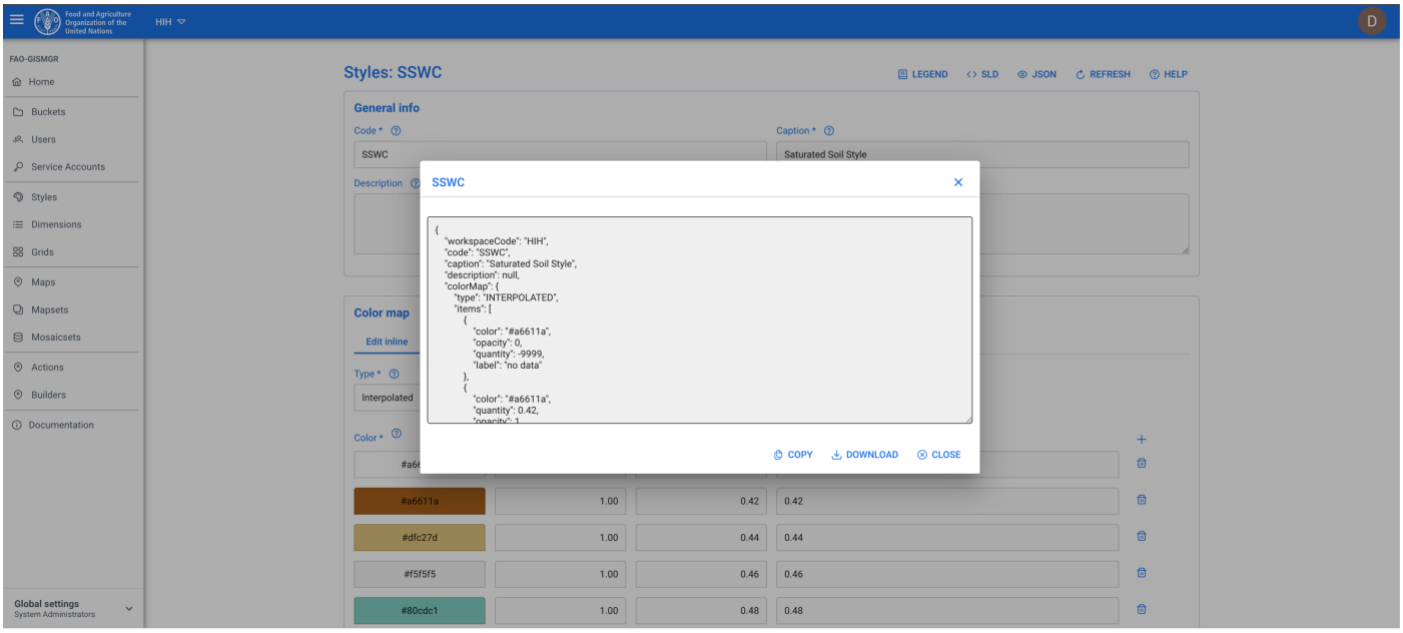

Figure 37 - View a Style – JSON.

6.5.2 View a Style - SLD

To view the SLD representation of a Style, the User must press the SLD button on the top right of the Style view page.

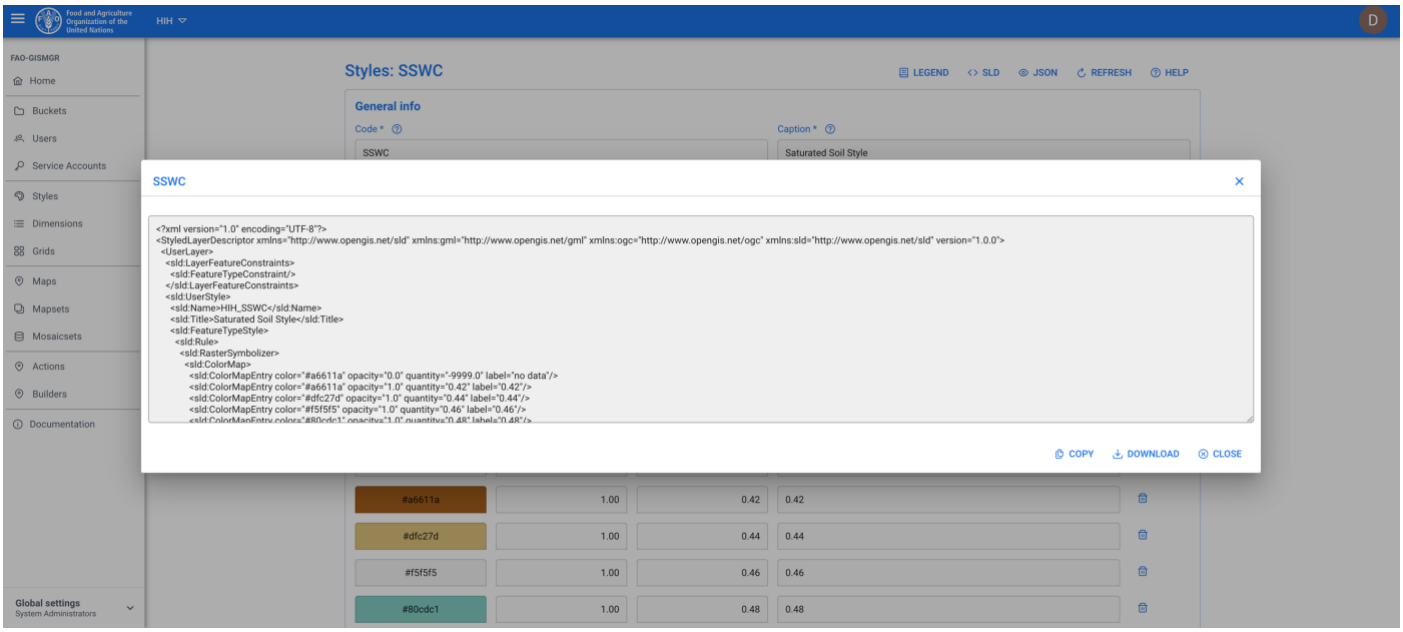

Figure 38 - View a Style – SLD.

6.5.3 View a Style - Legend (PNG) Image

To view the Legend (PNG) representation of a Style, the User must press the Legend button on the top right of the Style view page.

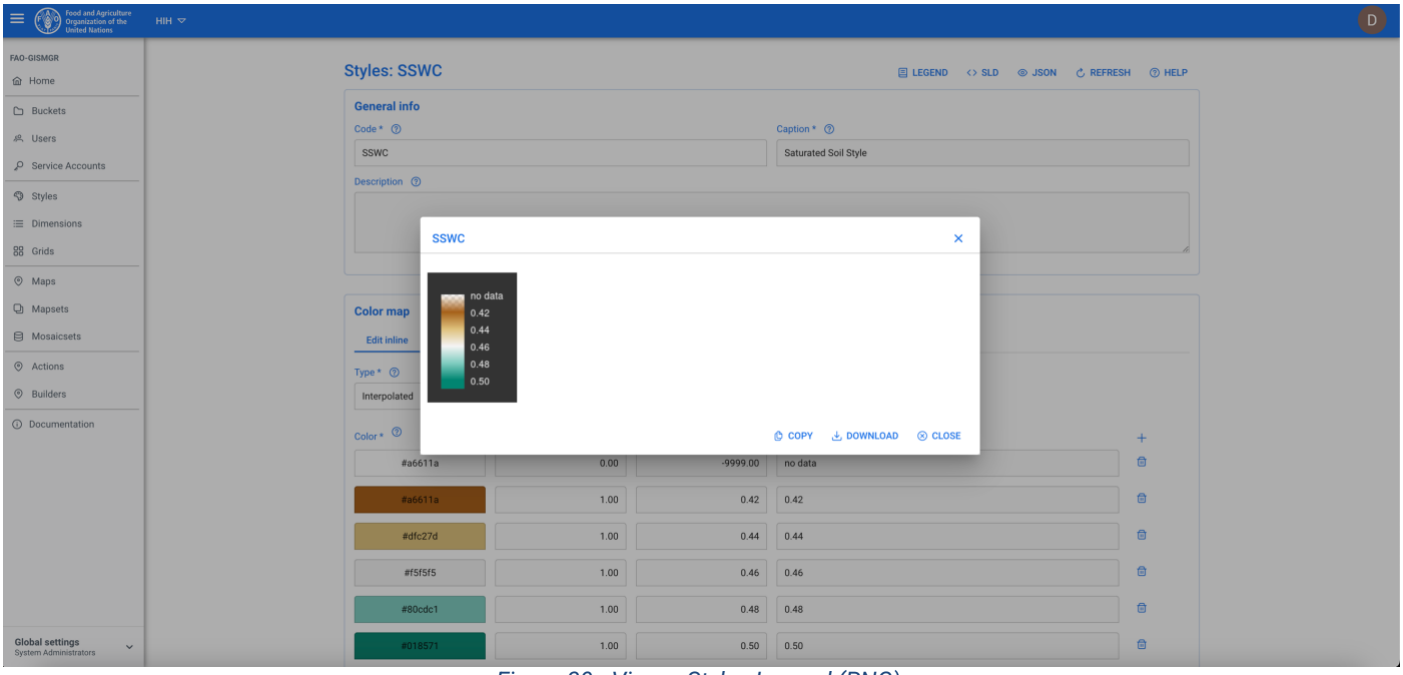

Figure 39 - View a Style - Legend (PNG).

6.6 Update a Style

To update a Style, the User must select an existing Style from the list of styles by clicking/tapping on the desired one. The system will display the selected Style input form to update the data. It is possible to update a Style either updating the data in the form or uploading a new SLD or JSON file. Once completed, the User must press the save button to save the changes. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

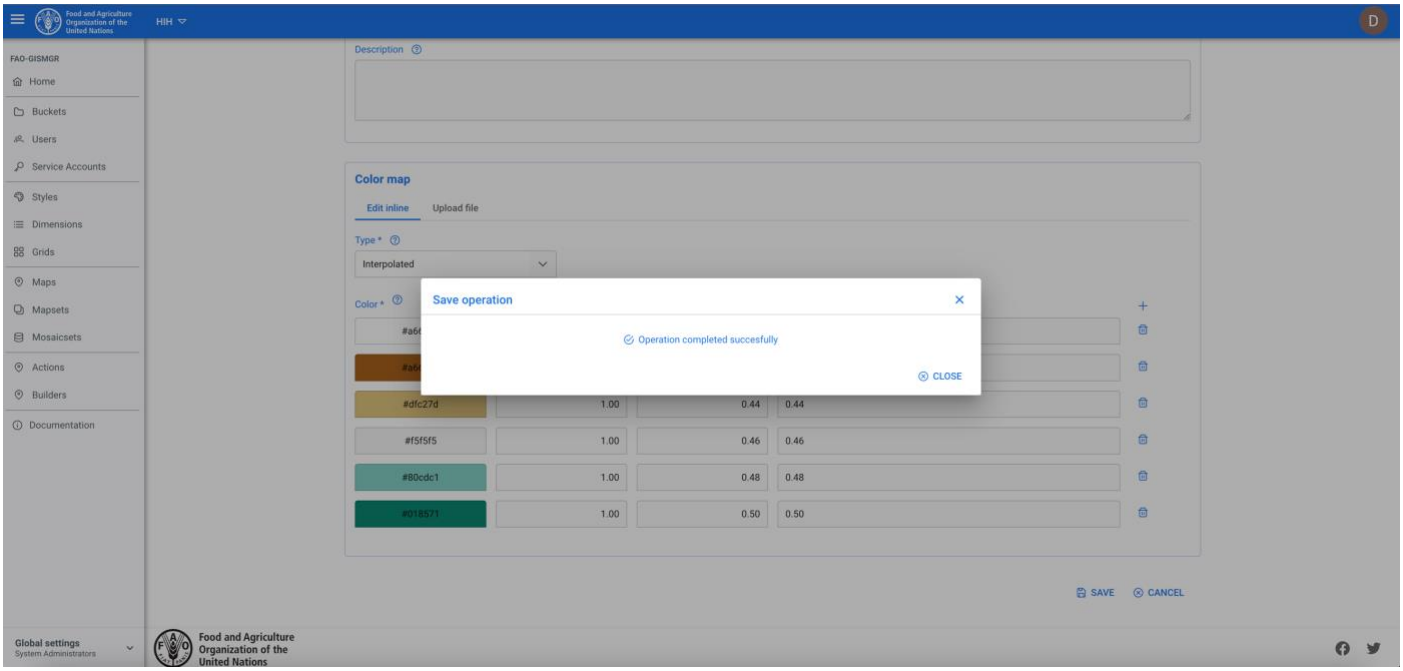

Figure 40 - Update a Style.

6.7 Delete a Style

To delete a Style, the User must select the Styles from the left menu. The system will display the list of all Styles for the selected Workspace. To delete a Style, the User must press the delete button of the Style to be deleted. The system will display the deletion confirmation popup message. The User must choose ok to confirm deletion or cancel to cancel the operation. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

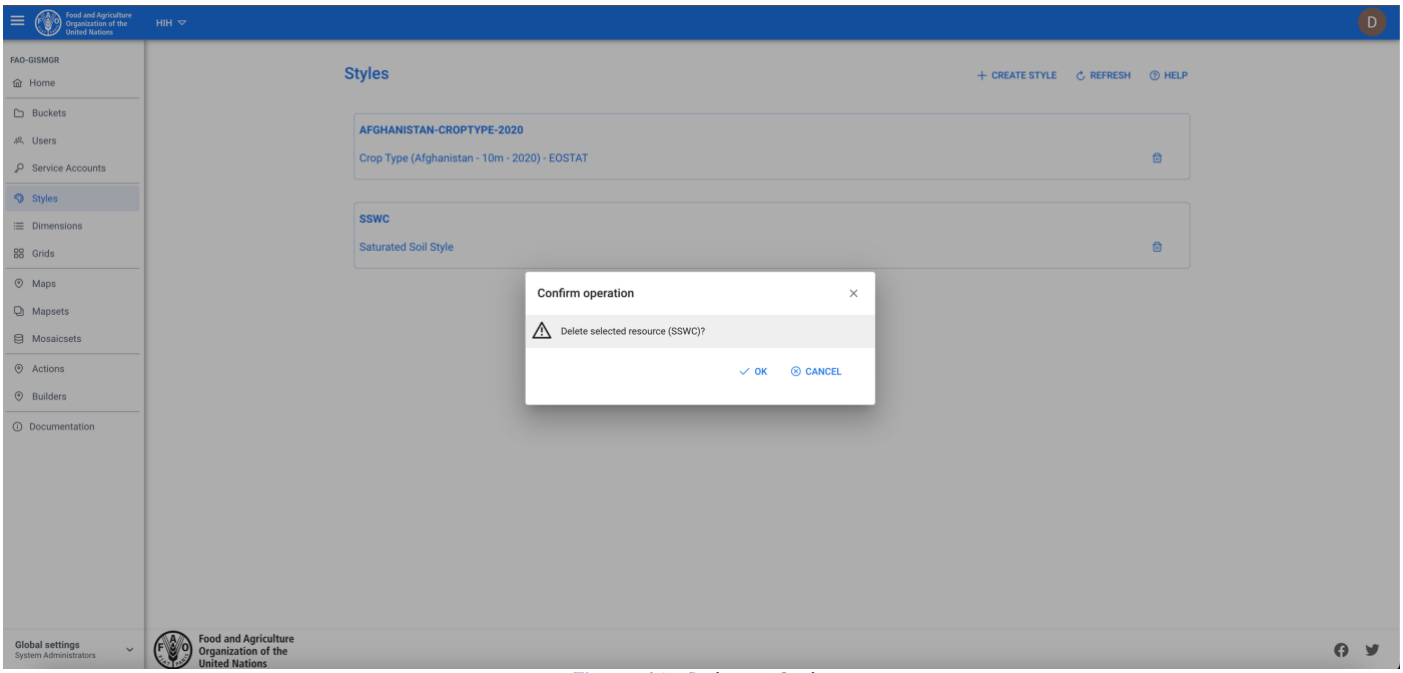

Figure 41 - Delete a Style.

7 Maps

In GISMGR a Map is formed by metadata that describes the resource and a *single raster layer*, namely a layer having, as its data source, a spatial data model that defines space as an array of equally sized cells arranged in rows and columns, generally stored on disk or in a (GIS) database.

A Map describes objects, events or other features with a location on or near the surface of the earth combining location information (usually coordinates on the earth) and attribute information (the characteristics of the object, event or phenomena concerned) with temporal information (the time or life span at which the location and attributes exist).

As geospatial data is most useful when it can be discovered, shared, analyzed and used in combination with traditional business data, GISMGR handles different input formats, continuous or categorized rasters, translates to COG format and finally stores/shares them (and their related metadata as JSON files) on workspaces' DATA buckets.

FIELD	DESCRIPTION
workspaceCode	`string`: unique code of the workspace to which the resource belongs. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
code	`string`: unique identifier of the resource. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
caption	`string`: a title or brief explanation of the resource. cannot be null; length must be min=3 and max=128; all characters except line breaks are allowed.
description	`string`: full or long explanation of the resource. can be null or empty;
styleCode	`string`: unique code of a previously defined style that must be applied for rendering the map's raster file. can be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
extensions	`array`: list of strings representing the expected raster dataset extensions. raster data can be formed by one or more files; set the expected extensions of the files that represent the full raster data, putting as first extension the main one. cannot be null (expected one extension at least); if formed by two or more files the file names must differ only in the extension part.
measureCaption	`string`: a title or brief explanation of the phenomenon being observed. can be null or empty
measureUnit	`string`: unit symbols of measurement. unit symbols are typically shortened versions of the unit name.

	can be null or empty; if the raster represents classes or categories unit value must be set equal to “class”
scale	double : slope of the slope-intercept form of linear equation to be applied to pixel value to get the actual value. cannot be null; default 1;
offset	double : intercept of the slope-intercept form of linear equation to be applied to pixel value to get the actual value. cannot be null; default 0;

flags	object : a JSON object representing pixel values with specific meaning.
	can be null; if provided for each pixel value the caption is mandatory, while description is optional.
	
	example:
	{
	"250": {
	"caption": "off season"
	},
	"251": {
	"caption": "no seasonality",
	}
	"253": {
	"caption": "insufficient data",
	}
	"254": {
	"caption": "no cropland / no grassland",
	}
	}

classes	object : a JSON object representing pixel values and their meaning.
	must be provided only if the measureUnit=class ; for each pixel value the caption is mandatory, while description is optional.
	
	example:
	{
	"1": {
	"caption": "Tree cover (dense) ",
	"description": "Tree cover with a canopy cover >70% and height exceeding 5m."
	},
	"4": {
	"caption": "Grassland",
	"description": "Mainly grass cover with woody vegetation, canopy cover <15%"
	},
	
	. . .
	
	"255": {
	"caption": "no data",
	"description": "no data"
	}
	}

translate	array : list of TranslateItem that define the *input raster to COG* format conversion process. can be null or empty; if not provided the default one is applied:

	<pre>[
	  {
	    "format": "GTiff",
	    "options": [
	      "INTERLEAVE=BAND",
	      "TILED=YES",
	      "COMPRESS=LZW"
	    ]
	  }
	]</pre>

additionalInfo	object : additional information about the resource. can be null; a freely structured JSON object provided by the data owner to better describe the resource
tags	array : list of string objects; can be null or empty; a **tag** is a keyword or term assigned to a piece of information to describe it.

Translate

FIELD	DESCRIPTION
subDataset	string : selects the name of the input sub-dataset. (some raster drivers, like NetCDF or HDF5, support multidimensional datasets)
band	string : selects an input band for output; bands are numbered from 1.
format	string : selects the output format (raster driver); use the short format/driver name; for the full list of supported raster drivers see here
dataType	string : forces the output raster bands to have a specific data type supported by the driver, which may be one of the following: • Byte • Int8 • UInt16 • Int16 • UInt32 • Int32 • UInt64 • Int64 • Float32 • Float64 • CInt16 • CInt32 • CFloat32 • CFloat64
noDataValue	string : assigns a specified no-data value to the output file. if you want to remove or avoid to assign a no-data value you can set this option equal to none. Note that this option will not update any pixel value.

scale	`array`: array of 4 elements (`string`): • `src_min` - input raster min value • `src_max` - input raster max value • `dst_min` - output raster min value • `dst_max` - output raster max value rescales the input pixel values from the range `{src_min..src_max}` to the `{dst_min..dst_max}` one

srs	`string`: assigns a specified projection to the output file
	the spatial reference systems (projection) can be expressed using an EPSG code or a PROJ.4 declaration string.
	
	examples:
	`EPSG:4326`
	or
	`+proj=longlat +datum=WGS84 +no_defs +type=crs`

extent	`array`: array of 4 elements (`string`): • `ulx` - upper left corner x coordinate • `uly` - upper left corner y coordinate • `lrx` - lower right corner x coordinate • `lry` - lower right corner y coordinate sets/assigns the georeferenced bounds of the output file. Note this option does not cause reprojection.
gridSubWindow	`array`: array of 4 elements (`string`): • `xoff` - grid window's upper left corner x coordinate (0-indexed) • `yoff` - grid window's upper left corner y coordinate (0-indexed) • `xsize` - window's width size expressed in pixels • `ysize` - window's height size expressed in pixels selects a subwindow from the source image for copying based on pixel/line (column/row) location.
srsSubWindow	`array`: array of 4 elements (`string`): • `ulx` - window's upper left corner x coordinate • `uly` - window's upper left corner y coordinate • `lrx` - window's lower right corner x coordinate • `lry` - window's lower right corner y coordinate selects a subwindow from the source image for copying based on georeferenced coordinates expressed in the SRS of the input raster Note that the SRS window will be previously translated to grid coordinates.
options	`array`: array of elements expressed in the `NAME=VALUE` form, where: • `NAME` is the name of the creation option • `VALUE` is the selected value to be assigned to the option

	defines the creation options for the output file. Many formats/drivers have one or more creation options that can be used to control particulars about the output file created. For instance, the GeoTIFF driver supports creation options to control compression, and whether the file should be tiled. The creation options available vary by format driver, and some simple formats have no creation options at all. See Raster drivers format specific documentation for legal creation options for each format. For the full list of supported raster drivers see here

7.1 List all Maps

To list all Maps, after selecting a workspace, the User must click the Maps button from the left menu. The system will display all Maps in the system, for the selected Workspace.

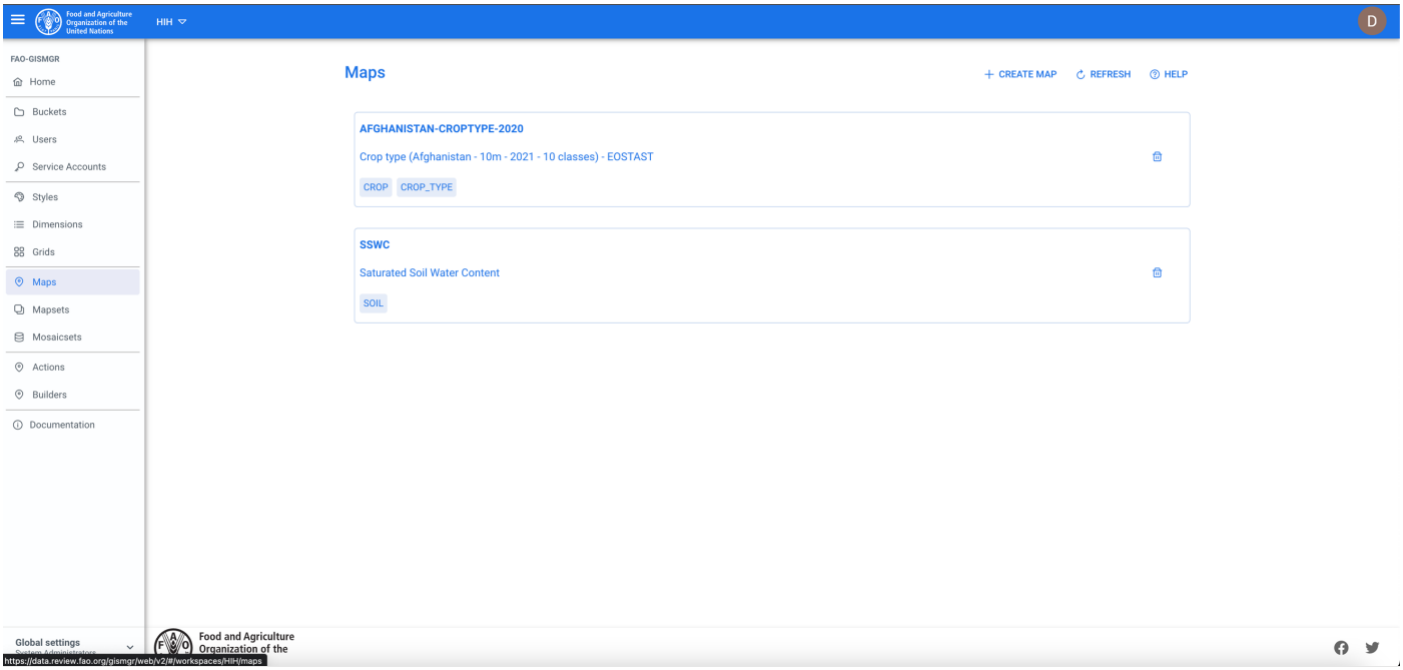

Figure 42 - List of all maps.

7.2 Create a Map

To create a new Map, after selecting a workspace, the User must browse to the Map page from the main menu. The system will display a list of the existing maps. The User must press the Create Map button on the top right of the page. The User must fill in the fields, the required ones being marked by an asterisk (*) and press the save button. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

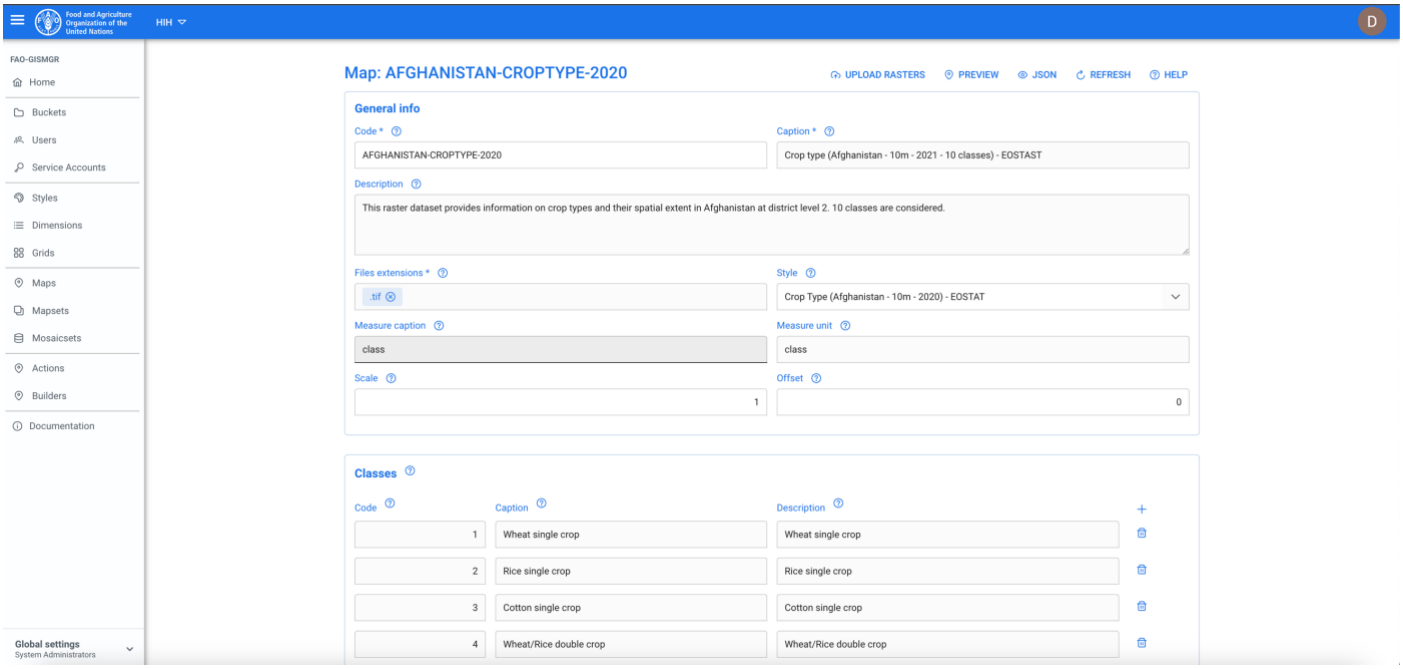

Figure 43- Create a Map.

The Translate/s is optional. If no translate is inserted, the system will automatically add a translate that transforms the uploaded file into a COG (-of GTiff INTERLEAVE=BAND -co TILED=YES -co COMPRESS=LZW).

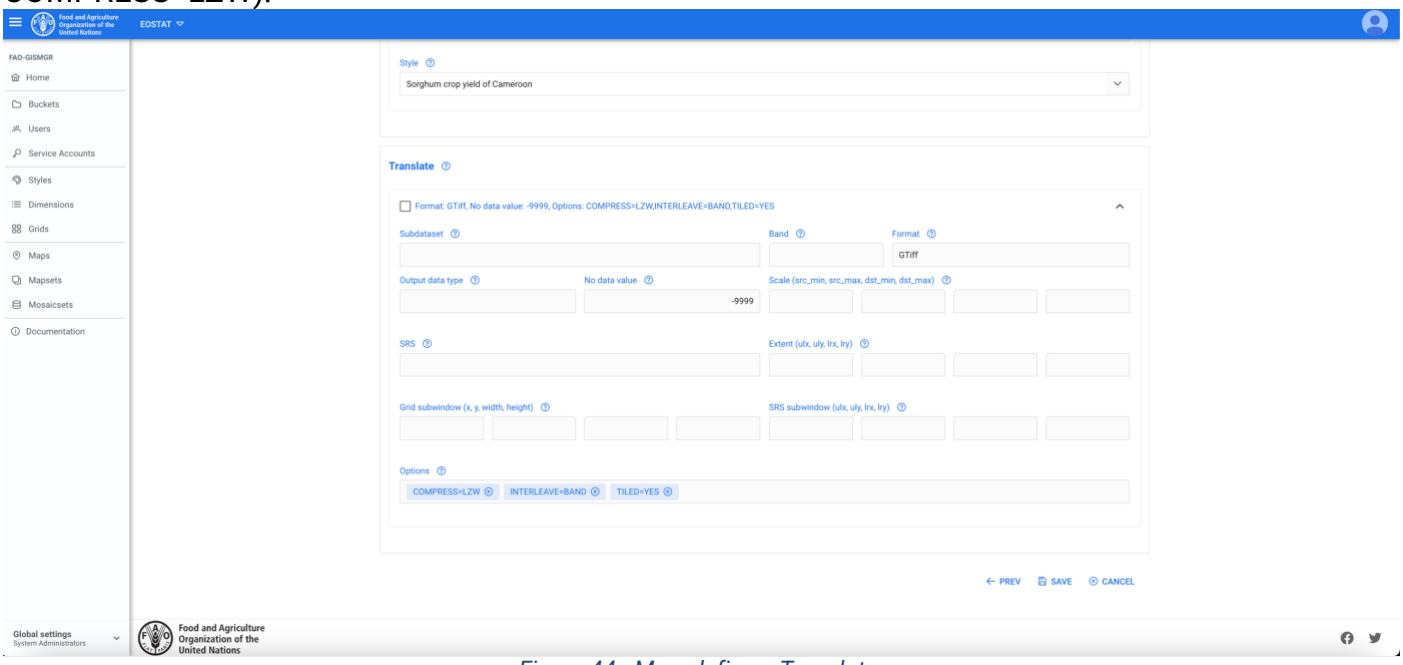

Figure 44 - Map, define a Translate.

7.3 Create a Map from a JSON file

It is also possible to create a Map uploading the JSON definition of a previously created Map. After selecting a Workspace, the User must browse to the Map page from the main menu. The system

will display a list of the existing maps. Press the Create Map button on the top right of the page. On the top right of the page the User must press the Upload Resource button.

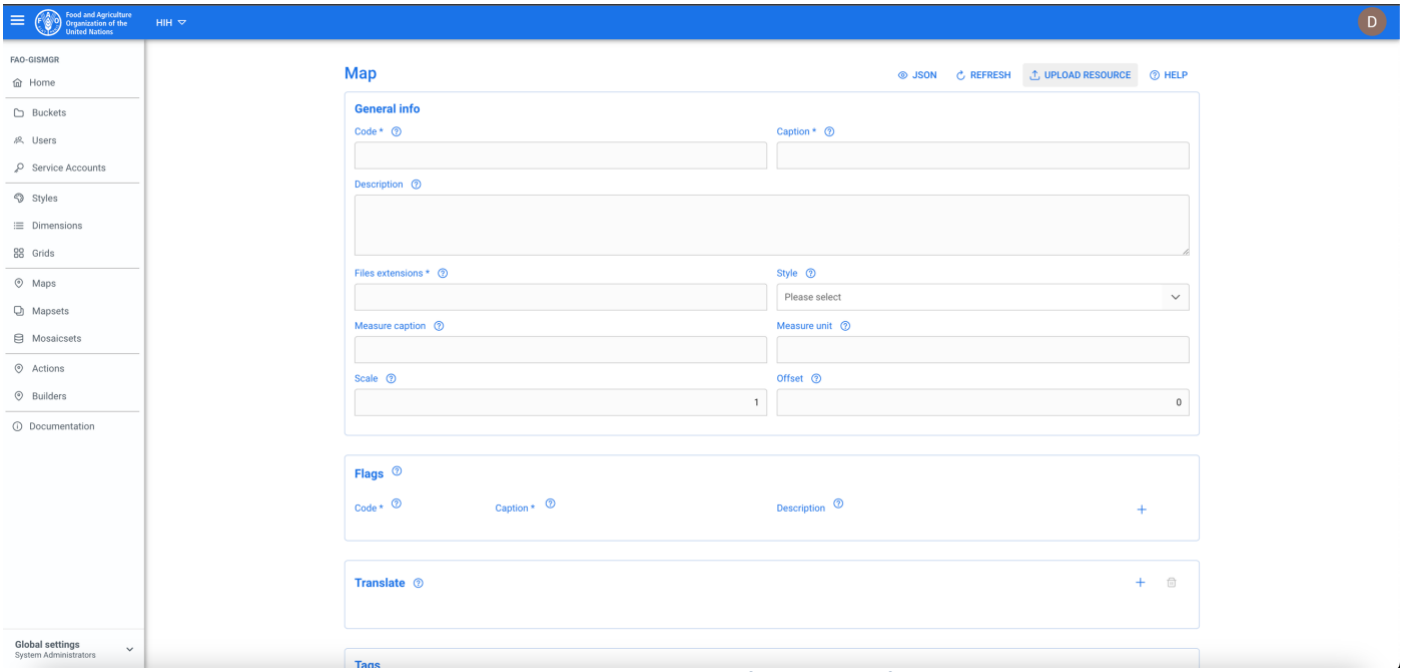

Figure 45 - Create a Map from a JSON file.

The system will open a window to choose a file from the file system. The User must select a valid JSON file (for example a JSON export from another map) and press the ok/open button, the popup will close. The system will populate the form with the data from the JSON file. From the main Map window, the User must press the save button. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

7.4 Update a Map

To update a Map, the User must select an existing Map from the list of maps by clicking/tapping on the desired one. The system will display the selected map input form to update the data. Once completed, the User must press the save button to save the changes.

If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

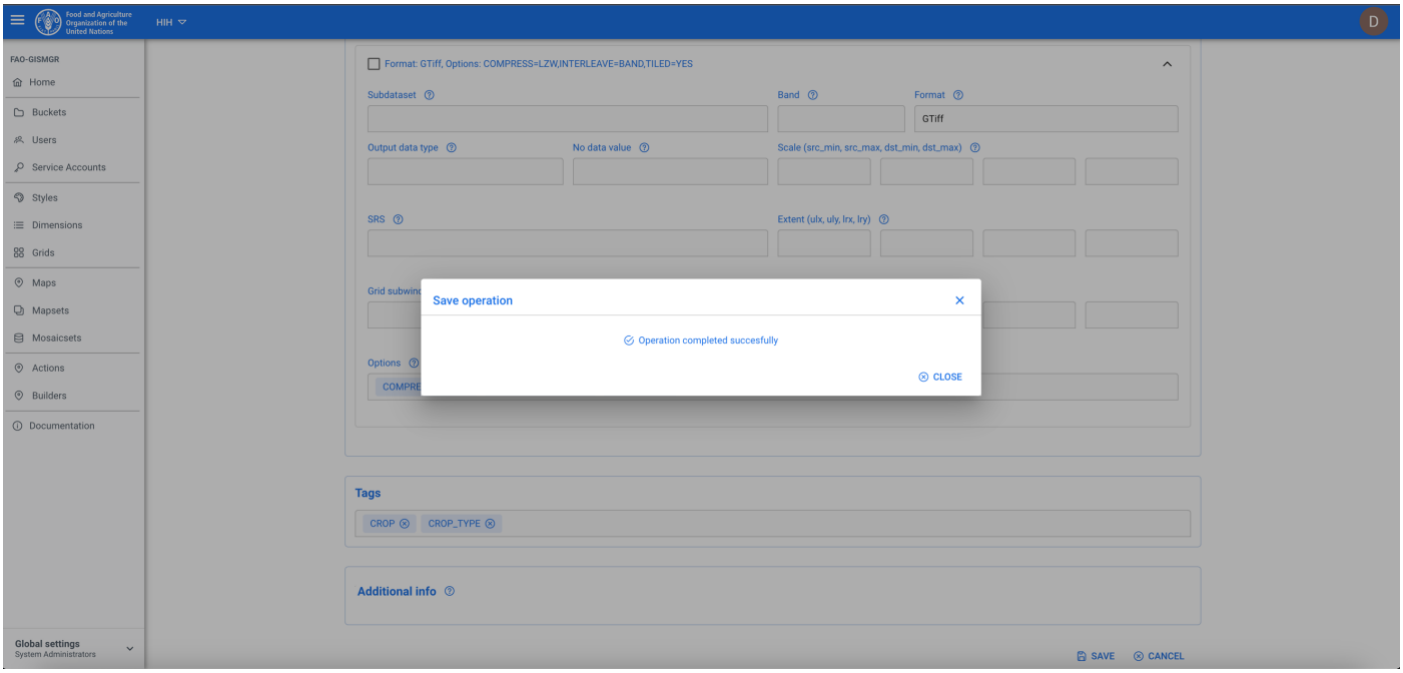

Figure 46 - Update a Map.

7.5 Upload a raster file/s

Once the metadata for the Map has been created/updated and saved, the User can upload, to the upload bucket, the file/files that constitute the Map. The User must browse to the upload bucket or click the Upload Rasters button on the top right of the Map detail window. The bucket page will open in the browser. The User must drag the file/s onto the bucket and the upload will start. Once the file is uploaded, the system will process the file/s in order to publish the Map.

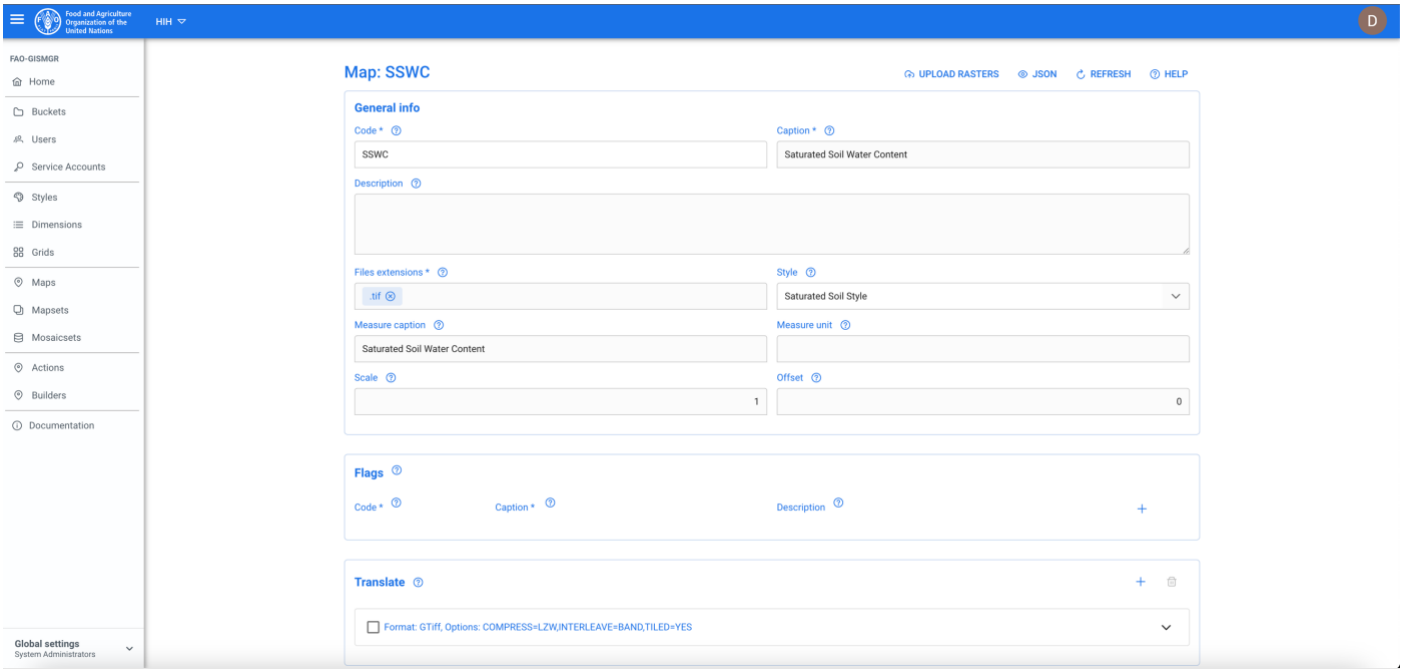

Figure 47 - Upload button in Map page.

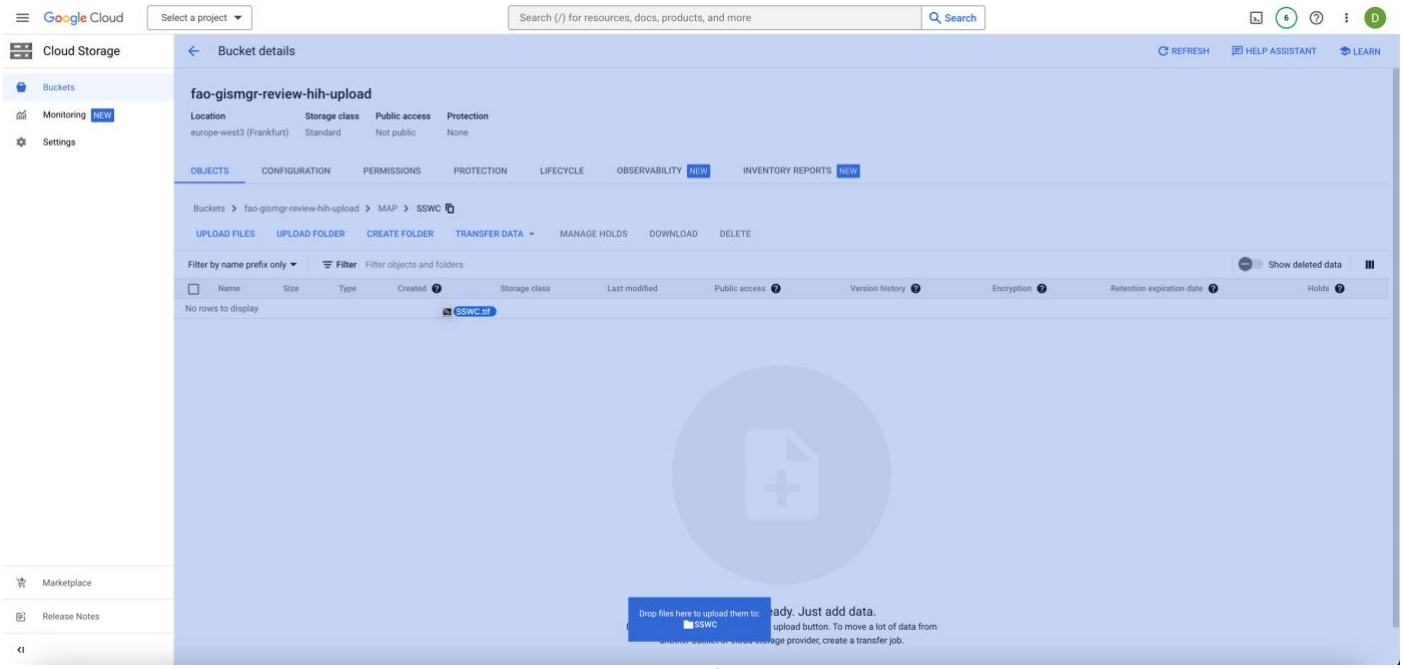

Figure 48 - Uploading a raster file in Google Cloud Storage.

7.6 Preview a Map

If the selected Workspace data bucket is PUBLIC, when a Map is created and the relative raster/s file/s have been uploaded to the upload bucket and processed successfully, the system will display a Preview button. Click the button to be redirected to a page with the map preview.

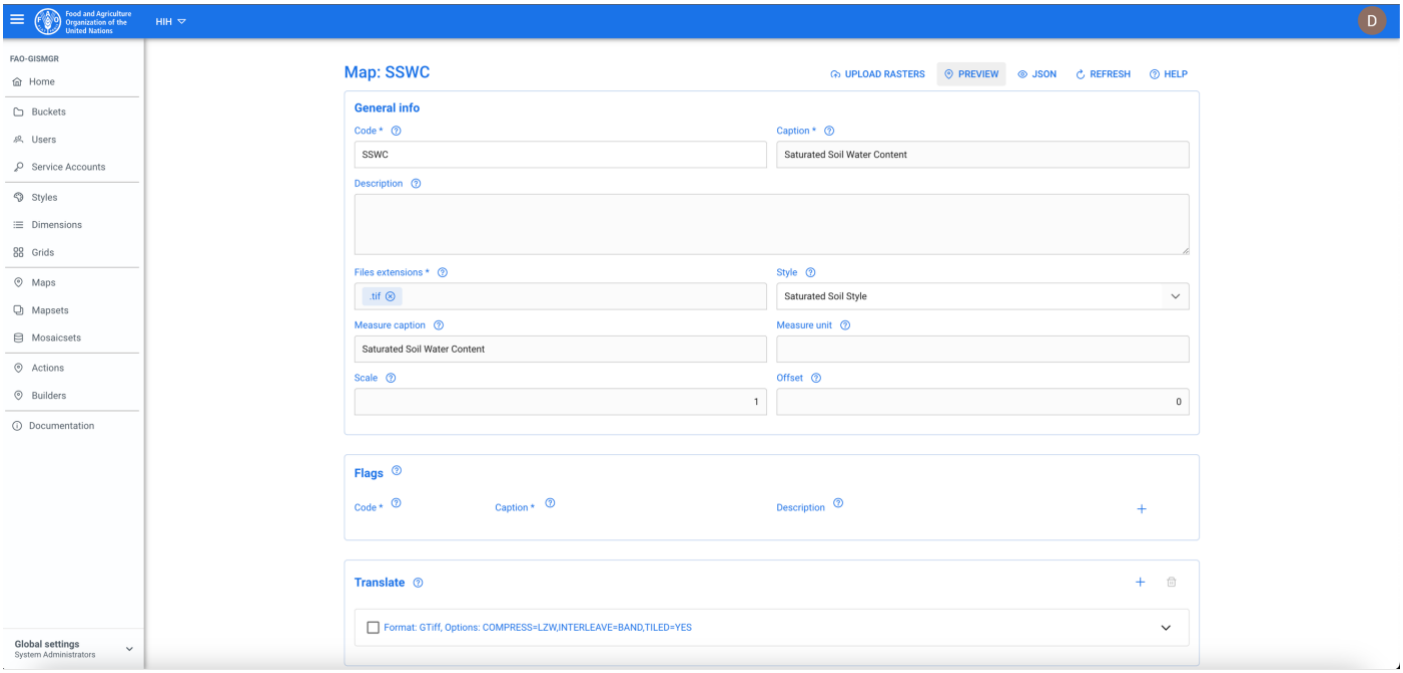

Figure 49 - Map preview button.

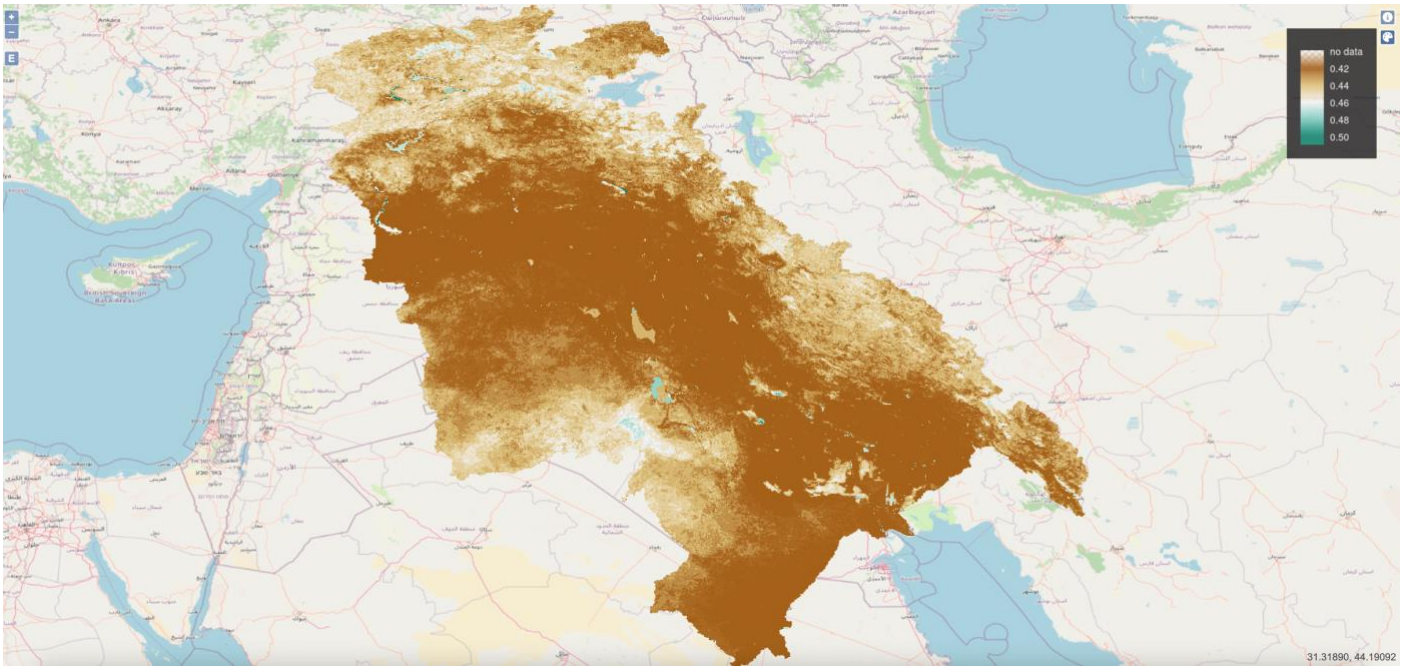

Figure 50 - Preview a Map.

7.7 Delete a Map

The User must press the Maps button from the left menu, after selecting a Workspace. The system will display the list of all Maps for the selected Workspace. To delete a Map, the User must press the corresponding delete button. The system will display the deletion confirmation popup message. The User must choose ok to confirm deletion or cancel to cancel the operation. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

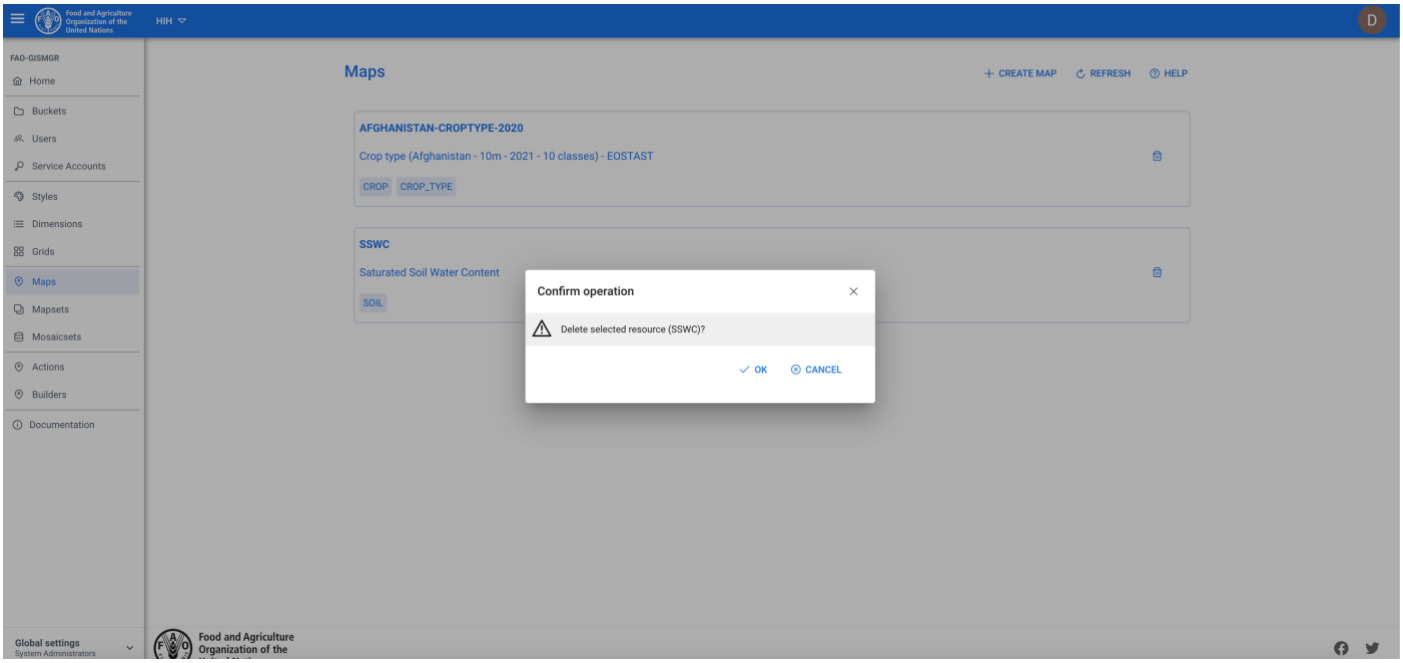

Figure 51 - Delete a Map.

8 Dimensions

Dimensions contain qualitative values (such as crops, dates, or countries) and can be used to categorize, segment and reveal the details in the data. In GISMGR, there are 2 types of dimensions, **WHAT** and **TIME**. **TIME** dimensions define the time periods that are used in the data model. The type of time period is defined in the time sub-type attribute of time dimensions (year, half-year, quarter, month, half-month, dekad, pentad, day, custom). Time dimensions with a subtype different than "custom" may only be defined in the **SHARED** workspace, while custom time dimensions may be defined in any workspace.

FIELD	DESCRIPTION
workspaceCode	string : unique code of the workspace to which the resource belongs. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
code	string : unique identifier of the resource. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
caption	string : a title or brief explanation of the resource. cannot be null; length must be min=3 and max=128; all characters except line breaks are allowed.
description	string : full or long explanation of the resource. can be null or empty;
type	string : can be **WHAT** or **TIME** cannot be null;
timeSubType	string: valid only if type=TIME. It can have one of the following values: • YEAR • HALF-YEAR • QUARTER • MONTH • HALF-MONTH • DEKAD • PENTAD • DAY • CUSTOM (only if the workspace code is not "SHARED")
tags	array : list of string objects; can be null or empty; a **tag** is a keyword or term assigned to a piece of information to describe it.

8.1 List all Dimensions

To list all Dimensions, after selecting a Workspace, the User must click the Dimensions button from the left menu. The system will display all Dimensions in the system, for the selected Workspace.

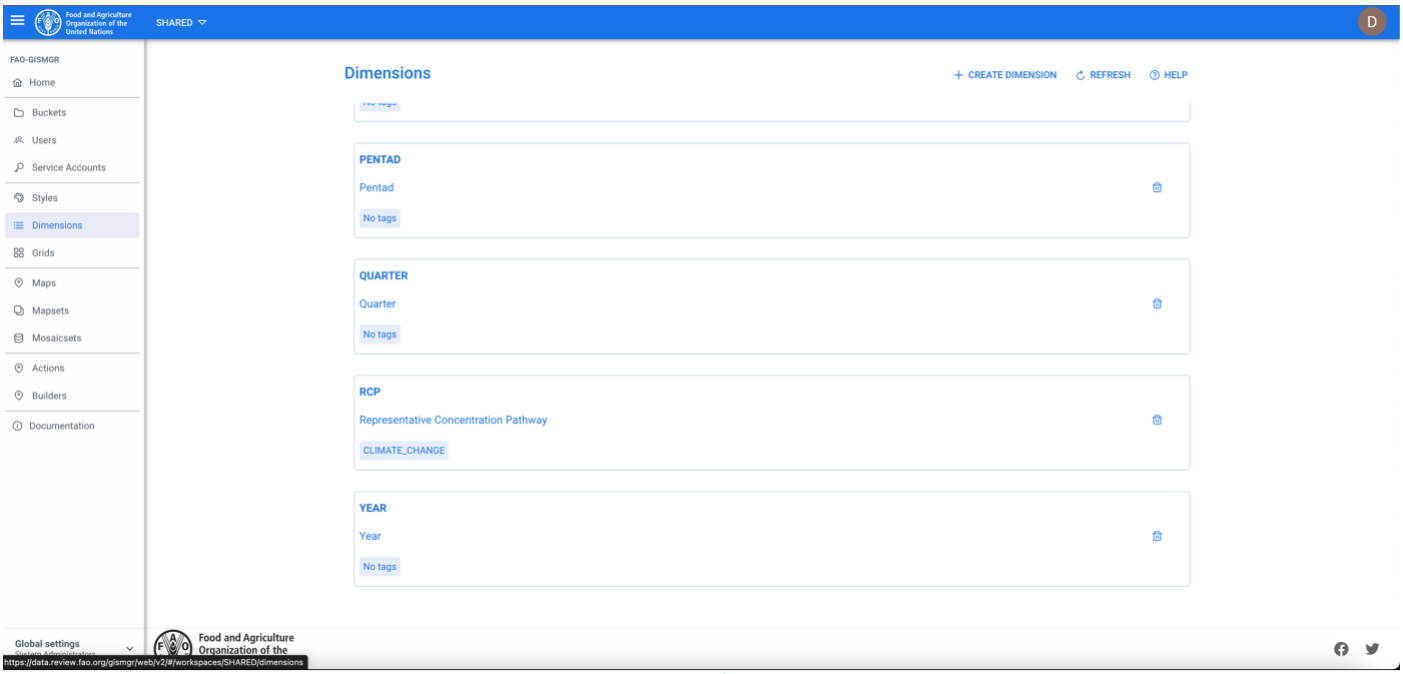

Figure 52 - List of Dimensions.

8.2 Create a Dimension

To create a new dimension, after selecting a Workspace, the User must browse to the dimension page from the main menu. The system will display a list of the existing Dimensions. To create a new Dimension, the User must press the Create Dimension button on the top right of the page, fill in the fields, the required ones being marked by an asterisk (*), and press the save button.

If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

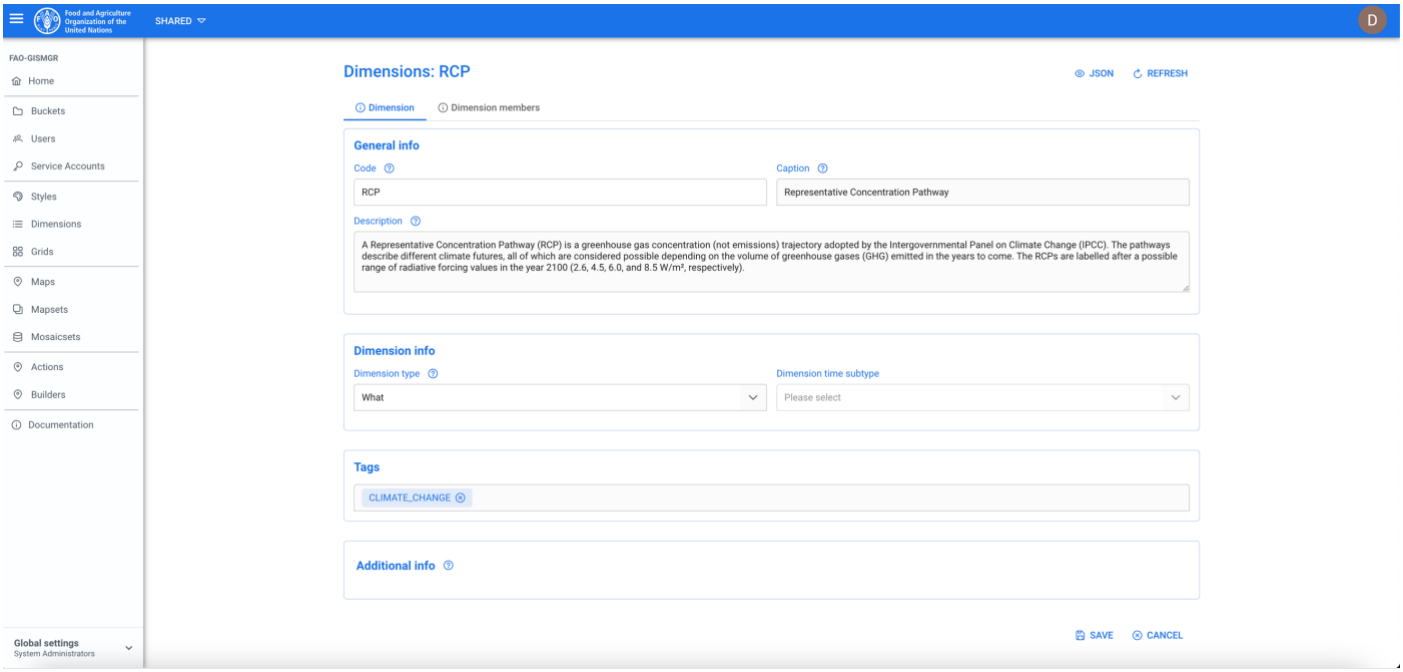

Figure 53 - Create a Dimension.

8.3 Update a Dimension

To update a Dimension, the User must select an existing Dimension from the list of Dimensions by clicking/tapping on the desired one. The system will display the selected Dimension input form to update the data. After editing the data, the User must press the save button to save the changes.

If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

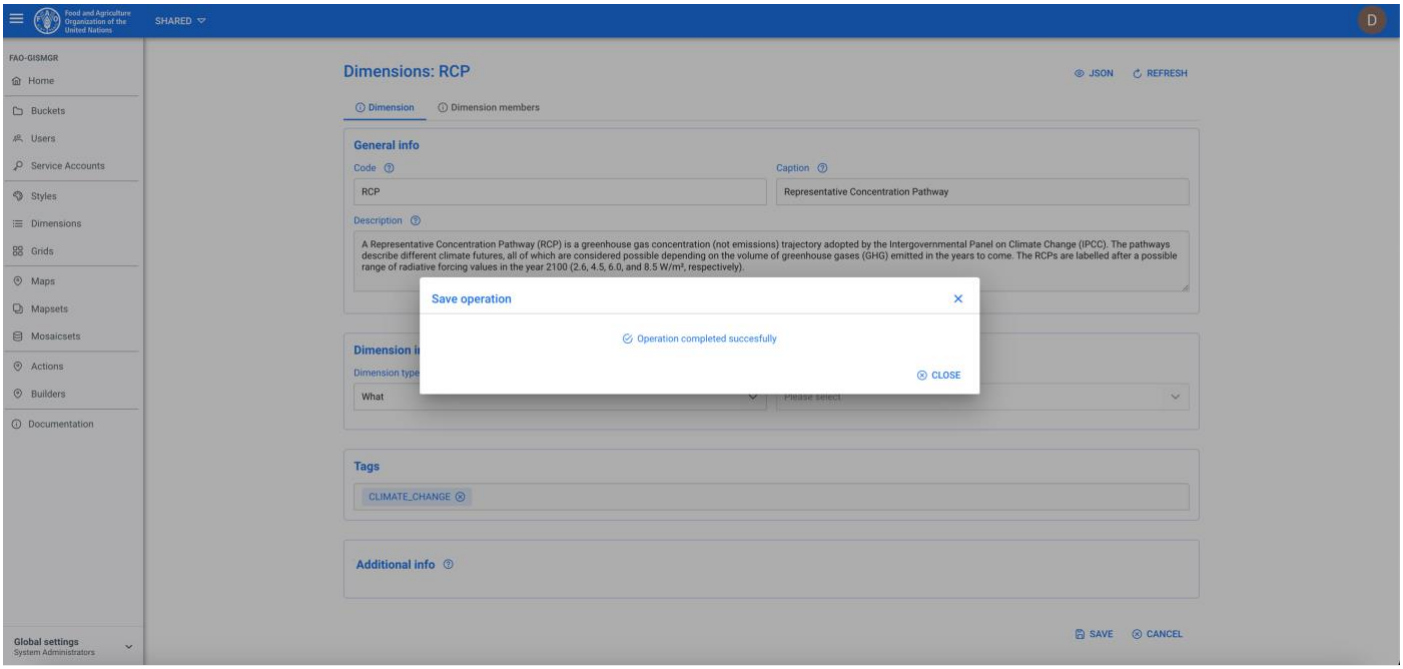

Figure 54 - Update a Dimension.

8.4 Delete a Dimension

The User must press the Dimensions button from the left menu. The system will display the list of all Dimensions for the selected Workspace. To delete a Dimension, the User must press the corresponding delete button. The system will display the deletion confirmation popup message. The User must choose ok to confirm deletion or cancel to cancel the operation. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

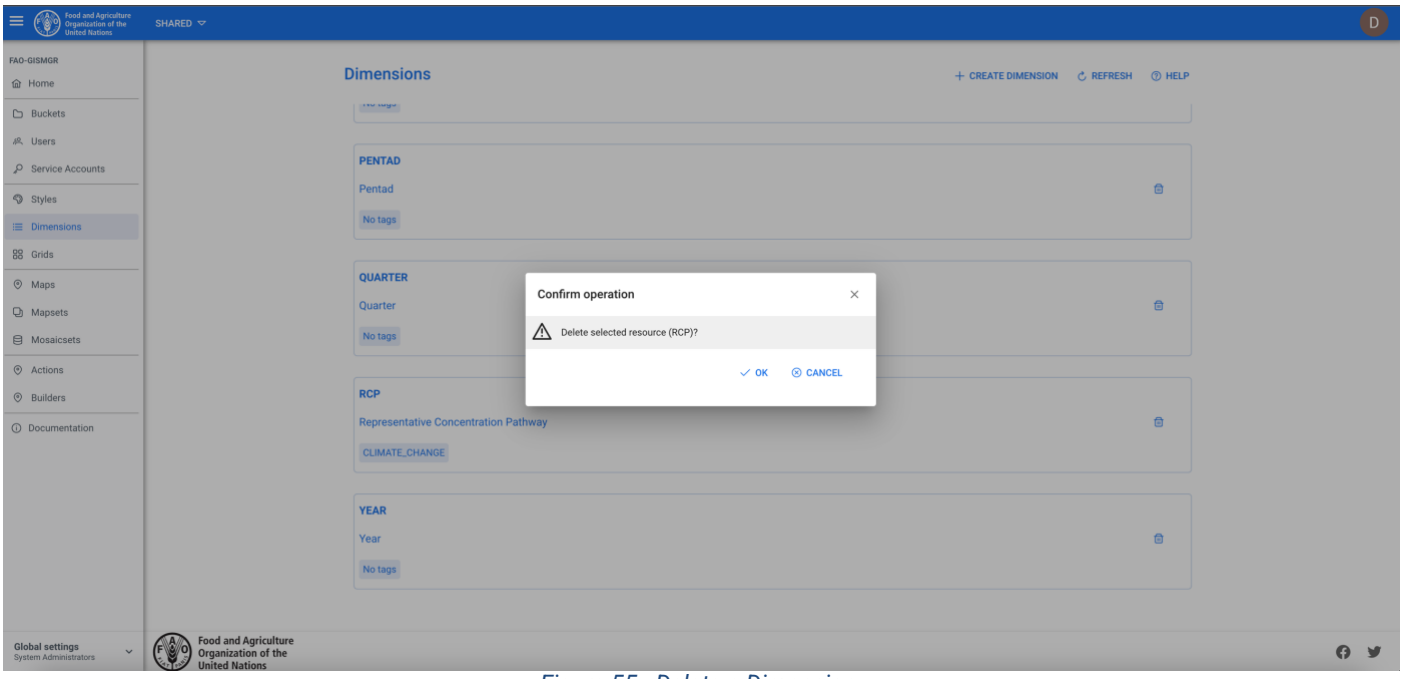

Figure 55 - Delete a Dimension.

8.5 Dimension Members

Dimension members are the possible values a Dimension can have. For a Country Dimension, these values could be Afghanistan, Belgium, Italy and so on, while for a Year time dimension, possible values could be 2001, 2002 and so on.

FIELD	DESCRIPTION
code	`string` : unique identifier of the resource. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
caption	`string` : a title or brief explanation of the resource. cannot be null; length must be min=3 and max=128; all characters except line breaks are allowed.
description	`string` : full or long explanation of the resource.

	can be null or empty;
index	integer : the index of the member within the dimension can be null

8.5.1 List all Dimension Members

Dimension members can be listed or edited only after the relative Dimension has been created. To list all Dimension Members of a Dimension, after selecting a Workspace, the User must click the Dimensions button from the left menu. The system will display all Dimensions in the system, for the selected Workspace. Select a Dimension and then select the Dimension Members tab.

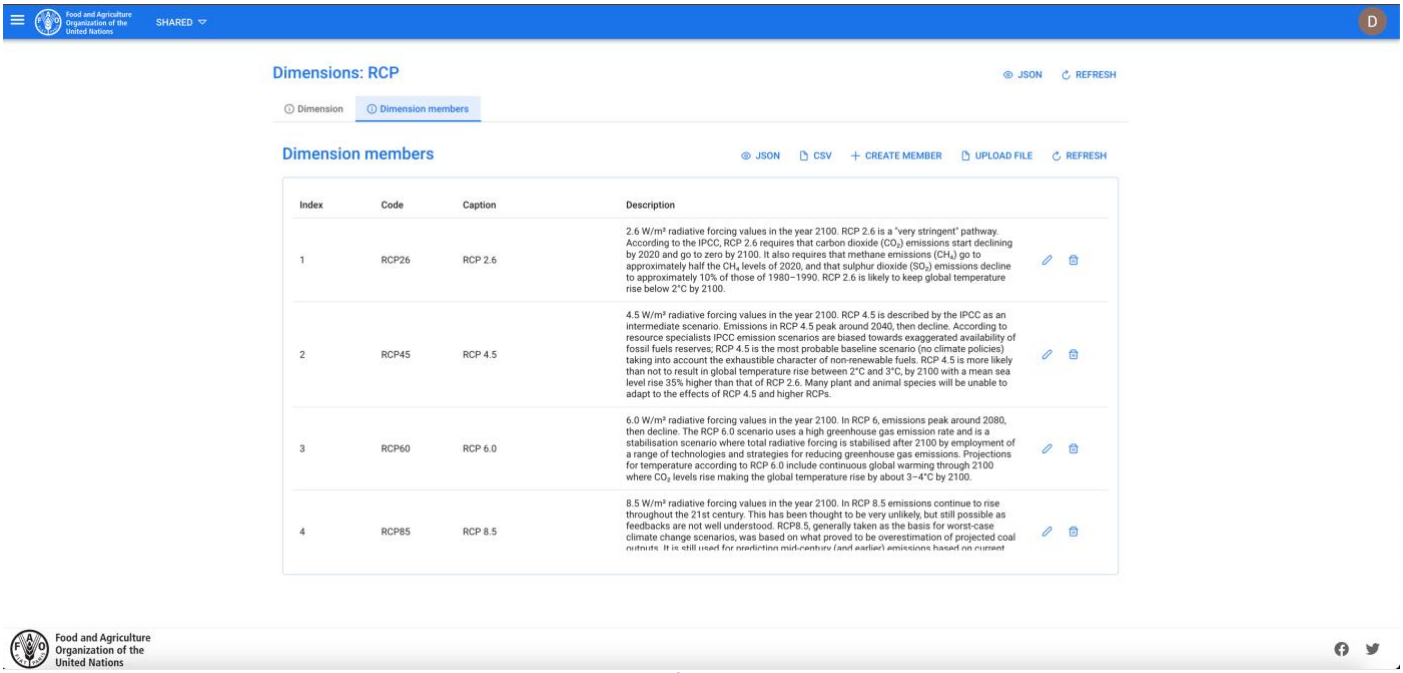

Figure 56 - List of Dimension Members.

8.5.2 Create a Dimension Member

To create a new Dimension Member, after selecting a Dimension, the User must select the Dimension Members tab. To create a new Dimension Member, the User must press the Create Member button on the top right of the page, fill in the fields, the required ones being marked by an asterisk (*) and press the save button.

If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message. The new Dimension Member will be displayed in the list below.

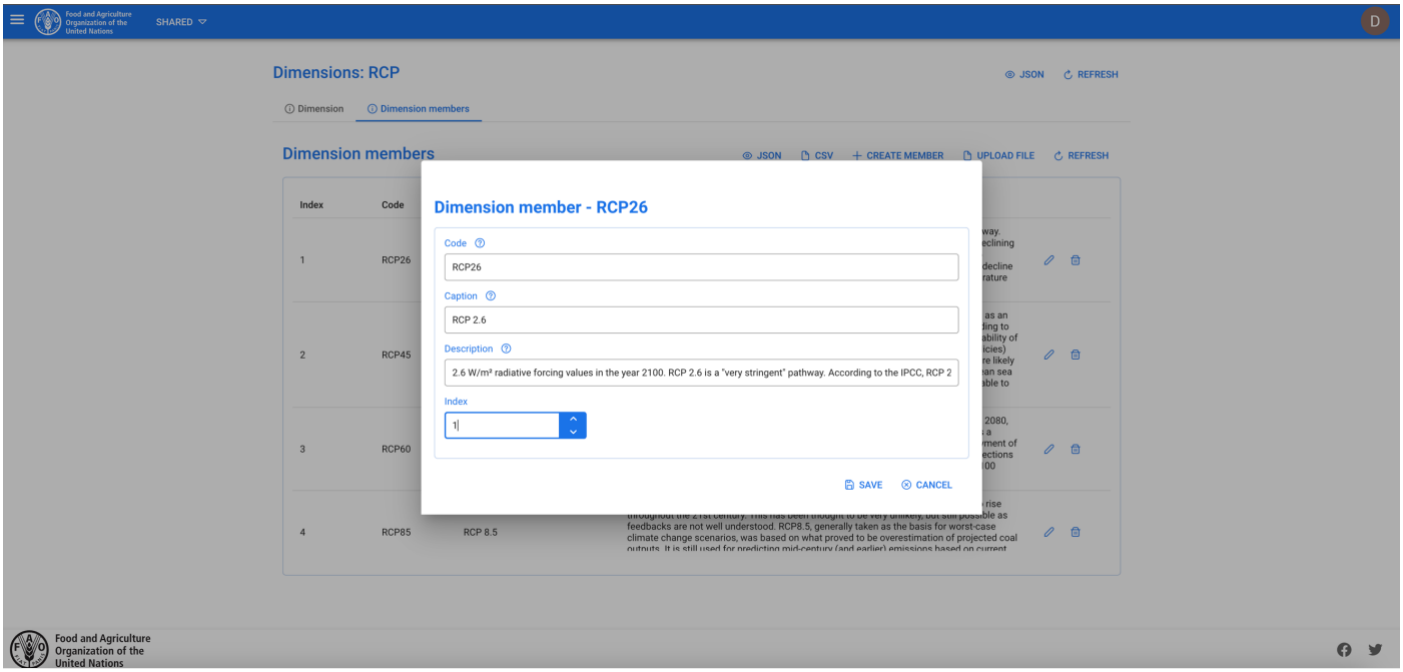

Figure 57 - Create a Dimension Member.

8.5.3 Update a Dimension Member

To update a Dimension Member, the User must select an existing Dimension from the list of Dimensions by clicking/tapping on the desired one and then press the Dimension Members tab. The System will display the list of Dimension Members. The User must press the edit (pencil) button of the Dimension Member to start editing. The System will display the editable fields (index, caption and description) input form. Once completed, the User must press the save button to save the changes. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

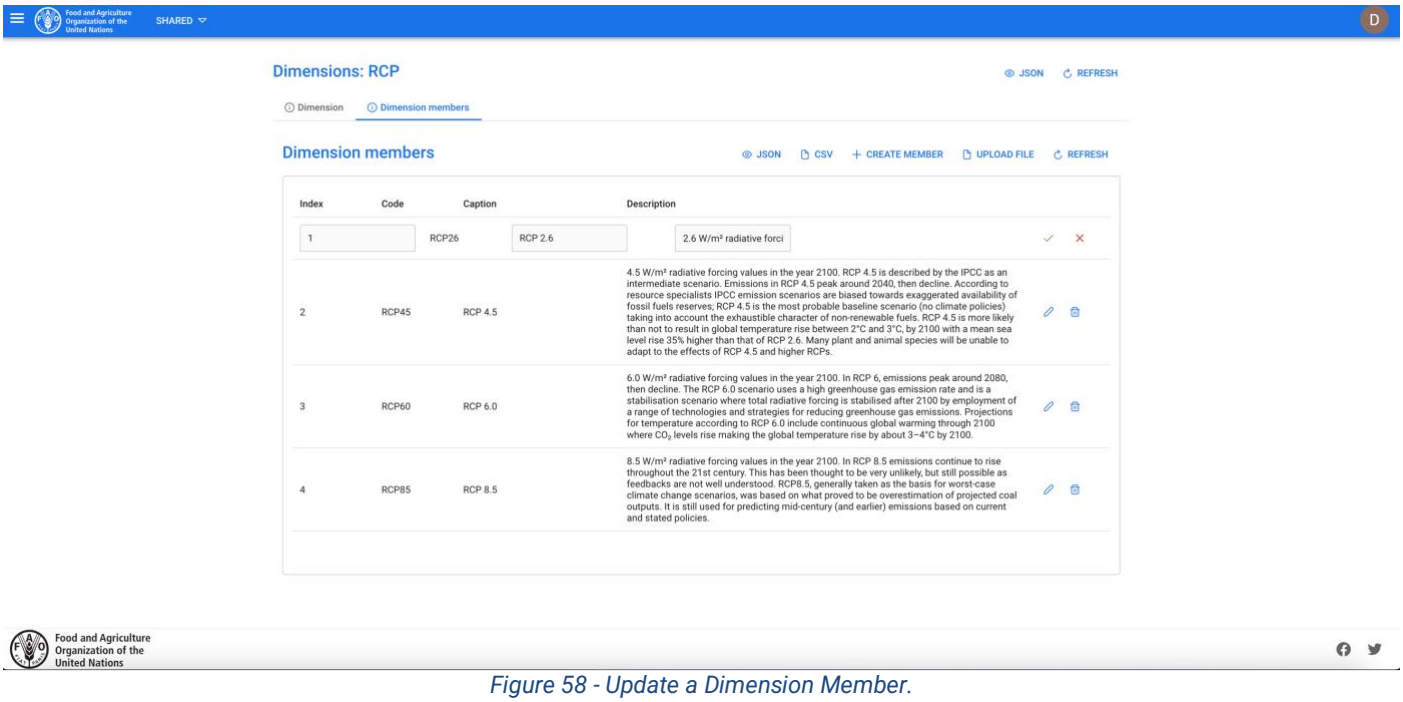

Figure 58 - Update a Dimension Member.

8.5.4 Delete a Dimension Member

To delete a Dimension Member, the User must select the Dimensions Members tab in the selected Dimension. The system will display the list of all Dimensions Members for the selected Dimension. To delete a Dimension Member, the User must press the corresponding delete button. The system will display the deletion confirmation popup message. The User must choose ok to confirm deletion or cancel to cancel the operation. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

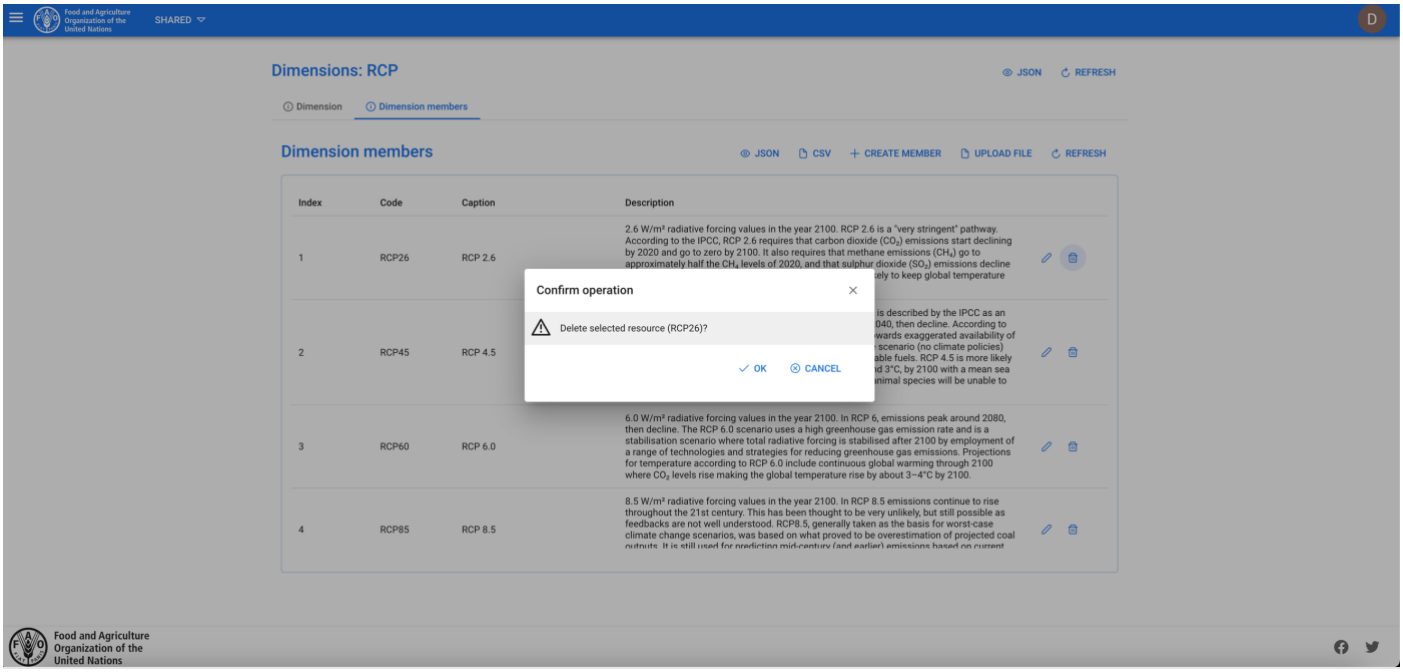

Figure 59 - Delete a Dimension Member.

8.5.5 Upload a file with Dimension Members

The User must select the Dimensions Members tab in the selected Dimension and click the Upload file button. The system will open a window to choose the file type (CSV, JSON, EXCEL) and a file from the file system. The User must select a valid file and press the ok/open button, the popup will close.

A valid JSON file would have the following format:

`Dimension Members` JSON representation

```
[
    {
        "code": "CODE-1"
        "caption": "Caption 1",
        "description": "Description 1",
        "index": 1
    },
    {
        "code": "CODE-2",
        "caption": "Caption 2",
```

```
        "description": "Description 2",
        "index": 2
    }
]
```

A valid CSV file would have the following format:

`Dimension Members` JSON representation

```
"CODE-1","Caption 1","Description 1",1
"CODE-2","Caption 2","Description 2",2
```

The User can select whether the new Dimension Members should replace the previous ones or not and press the save button. If the operation is completed successfully the system will display a confirmation message and the uploaded members will be displayed in the window below, otherwise it will display the error message. It is now possible to see the color map loaded from the file also in the main form.

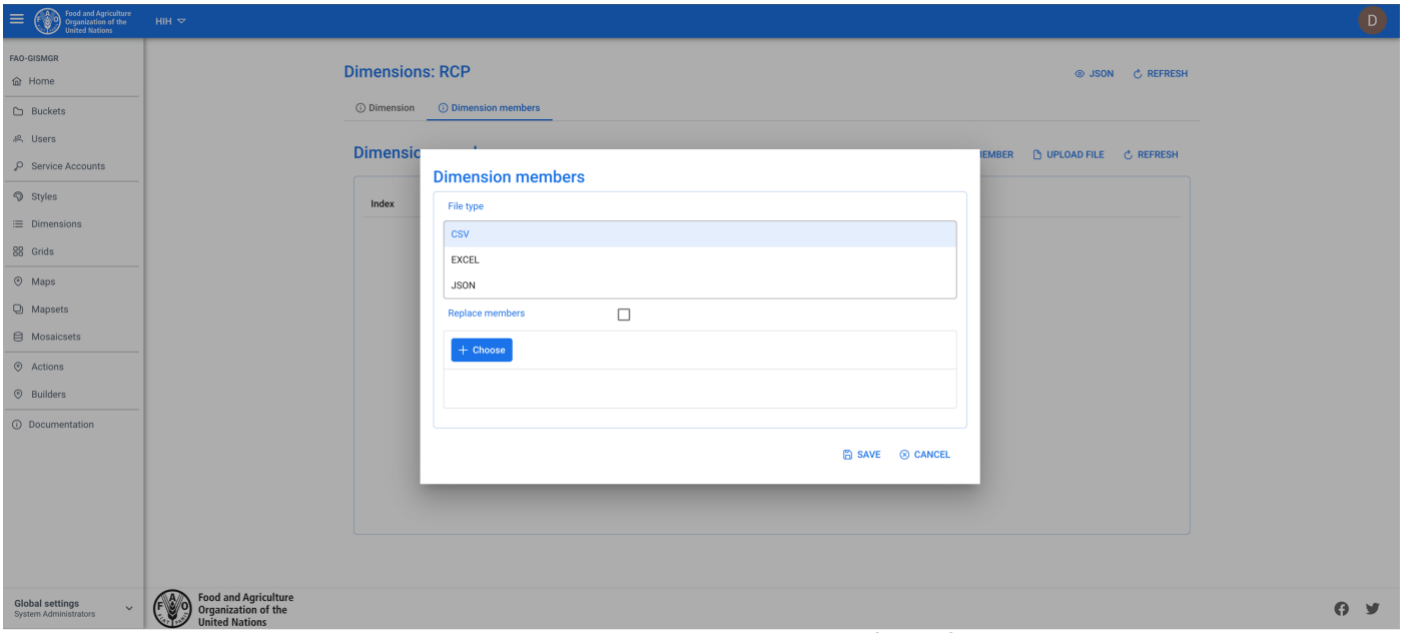

Figure 60 - Uploading Dimension Members from a file.

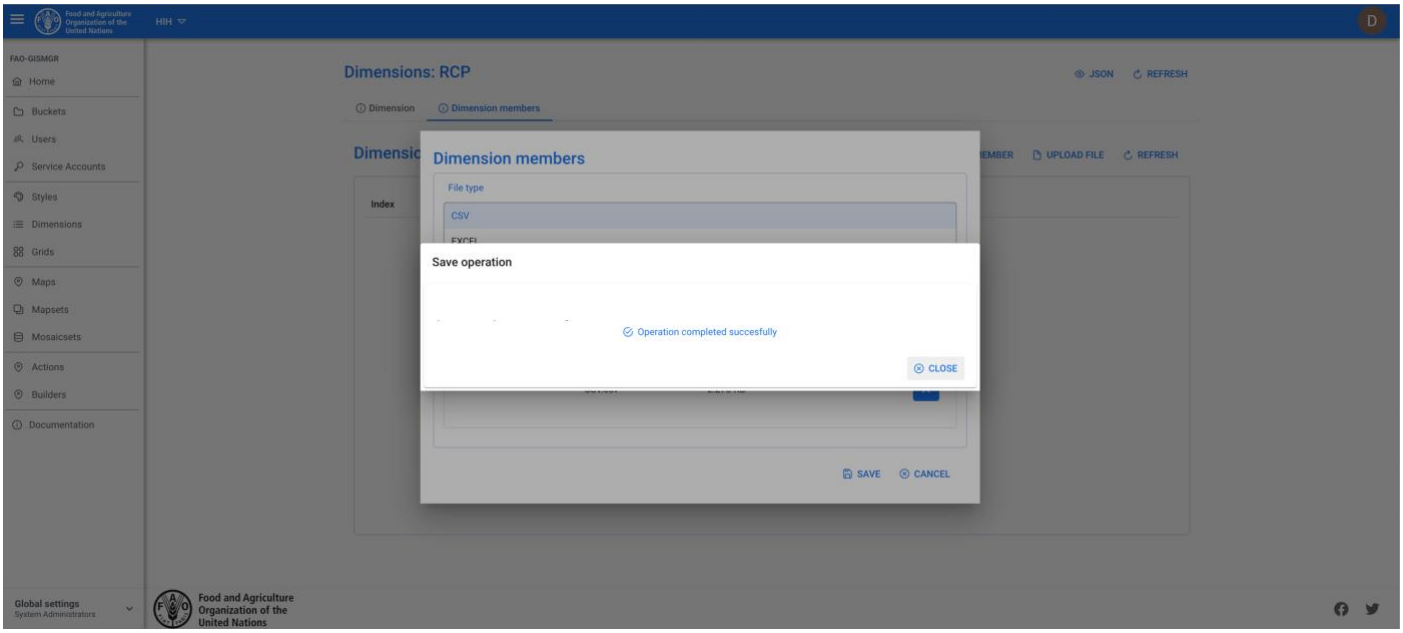

Figure 61 - Saving new Dimension Members.

9 Grids

A spatial GRID is set of one or more Tiles that can either overlap partially or be totally disjointed. Every tile has a unique code and has the following different GIS properties:

- **width** (expressed in number of pixels)
- **height** (expressed in number of pixels)
- **crs/srs** - coordinate/spatial reference system (expressed as PROJ4 definition string)
- **affine transform** (expessed in the units of the declared CRS/SRS)

A Grid can be used to define a Mosaicset so that all its data raster files are compliant with the GIS info of one, and only one, of the relative Grid ‘s Tile. After defining and saving the metadata of the Grid, the **Grid Tiles** can be defined uploading the raster files inside the Grid's folder (created by the system) on the Workspace's Upload bucket.

The naming convention of the raster file representing the Grid Tile must adhere to one of the following rules:

- **<CODE>.<extension>**
- **<CODE>.MASK.<extension>**

where:

<CODE> is the unique code of the tile:

- cannot be null
- length must be min=3 and max=32
- allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-)
- cannot start and/or end with an hyphen

<extension> is the file extension related to the raster file format (driver).
(The raster can be formed also by multiple files that must have same code but different extensions)

If a **<CODE>.<extension>** file is uploaded, GISMGR will create a new raster file (COG) having:

- 1 band with Byte (8 bit UInt) data type
- width, height, SRS and affine transform equal to the ones of the uploaded file
- all the pixels value set equal to 1
- no-data value set equal to 0

If a **<CODE>.MASK.<extension>** file is uploaded GISMGR will check that the mask file has:

- 1 band with Byte (8 bit UInt) data type
- **valid** pixels value set equal to **1**
- **not valid** pixels value set equal to **0**
- no-data value set equal to 0 (this is not mandatory)

If the uploaded raster file passes the above validation, GISMGR will translate it in COG file setting the no-data value equal to 0. It is better to upload mask files because GISMGR, while creating new output data, will be much faster as it will compute the output pixel value only where the mask is equal to 1.

FIELD	DESCRIPTION
workspaceCode	string : unique code of the workspace to which the resource belongs. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
code	string : unique identifier of the resource. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
caption	string : a title or brief explanation of the resource. cannot be null; length must be min=3 and max=128; all characters except line breaks are allowed.
description	string : full or long explanation of the resource. can be null or empty;
extensions	array : list of strings representing the expected raster dataset extensions. raster data can be formed by one or more files; set the expected extensions of the files that represent the full raster data, putting as first extension the main one. cannot be null (expected one extension at least); if formed by two or more files the file names must differ only in the extension part.
additionalInfo	object : additional information about the resource.

	can be null; a freely structured JSON object provided by the data owner to better describe the resource
`tags`	`array`: list of `string` objects; can be null or empty; a **`tag`** is a keyword or term assigned to a piece of information to describe it.

9.1 List all Grids

To list all Grids, after selecting a Workspace, the User must click the Grids button from the left menu. The system will display all Grids in the system, for the selected Workspace.

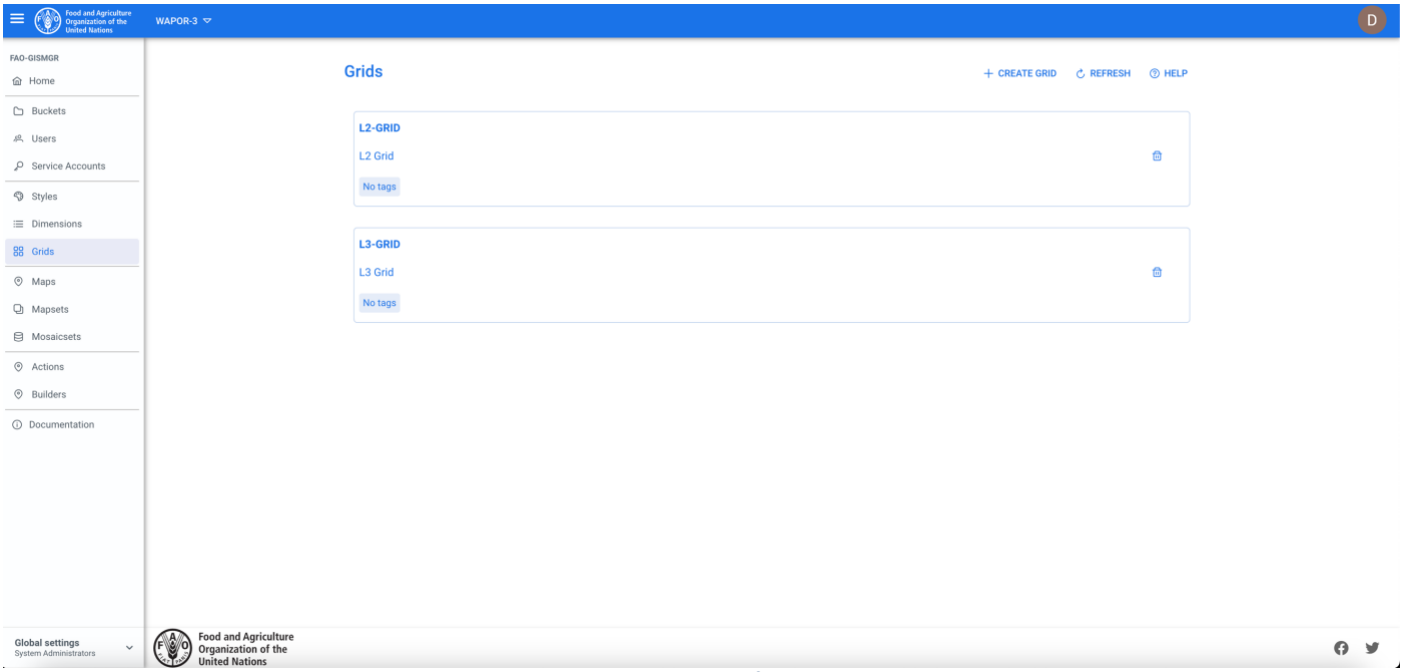

Figure 62 - List of Grids.

9.2 Create a Grid

To create a new Grid, after selecting a Workspace, the User must browse to the Grid page from the main menu. The system will display a list of the existing grids. The User must press the Create Grid button on the top right of the page, fill in the fields, the required ones being marked by an asterisk (*) and press the save button. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

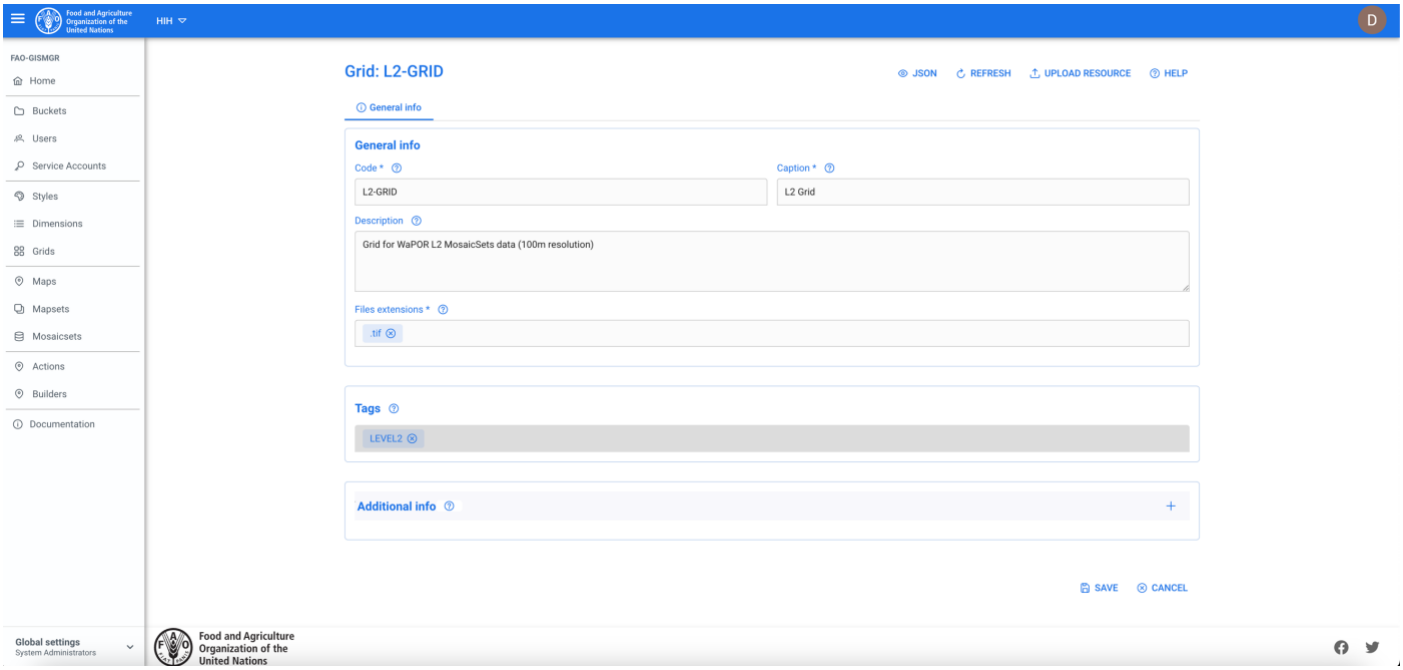

Figure 63 - Create a Grid.

9.3 Update a Grid

The User must select the Grids button from the left menu. The system will display the list of all Grids. To update a Grid, the User must select an existing grid from the list of Grids by clicking/tapping on the desired one. The system will display the selected Grid input form to update the data. Once completed, the User must press the save button to save the changes. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

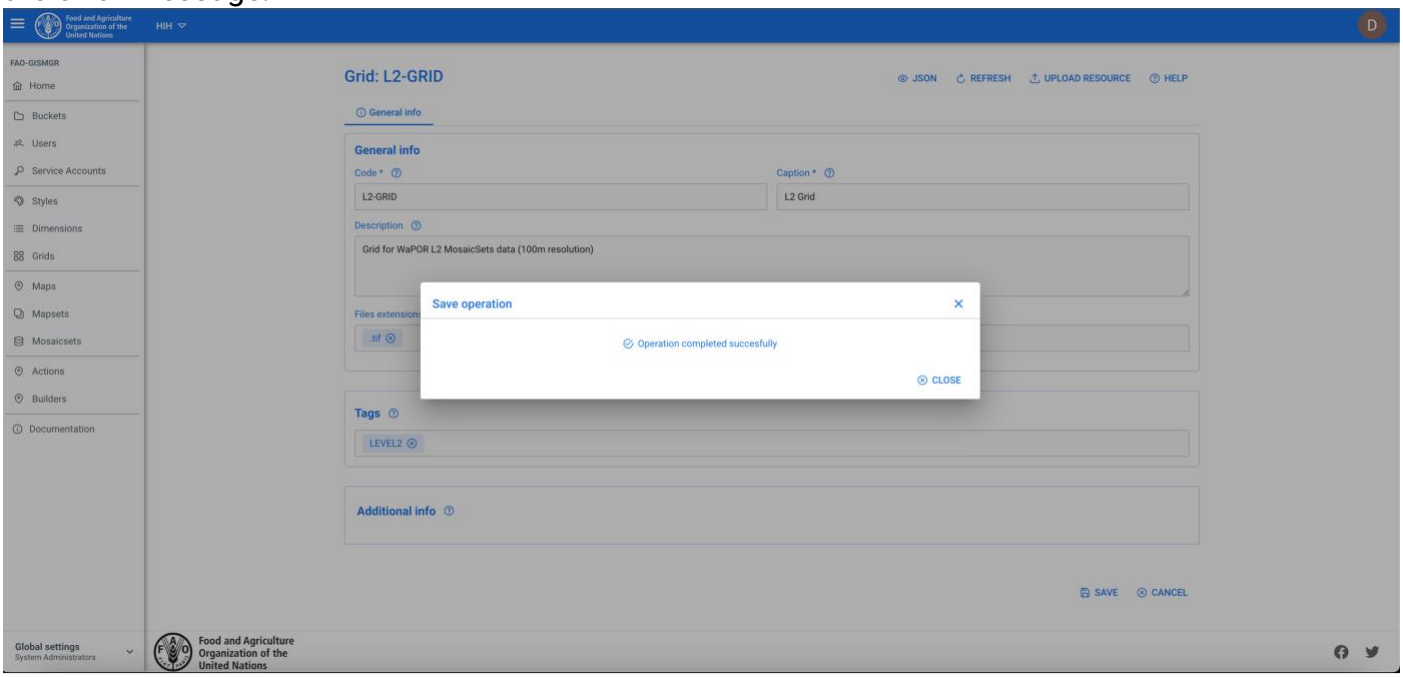

Figure 64 - Update a Grid.

9.4 Upload the Grid Tiles

Once the metadata for the Grid has been created/updated, the User can can upload, to the upload bucket, the file/files that constitute the Grid (**Tiles**). To upload the Tiles, the User must Browse to the Upload bucket or click the Upload Rasters button on the top right of the Grid detail window. The bucket page will open in the browser. The User must drag the file/s onto the bucket and the upload will start. Once the files are uploaded, the system will process the file/s to publish them.

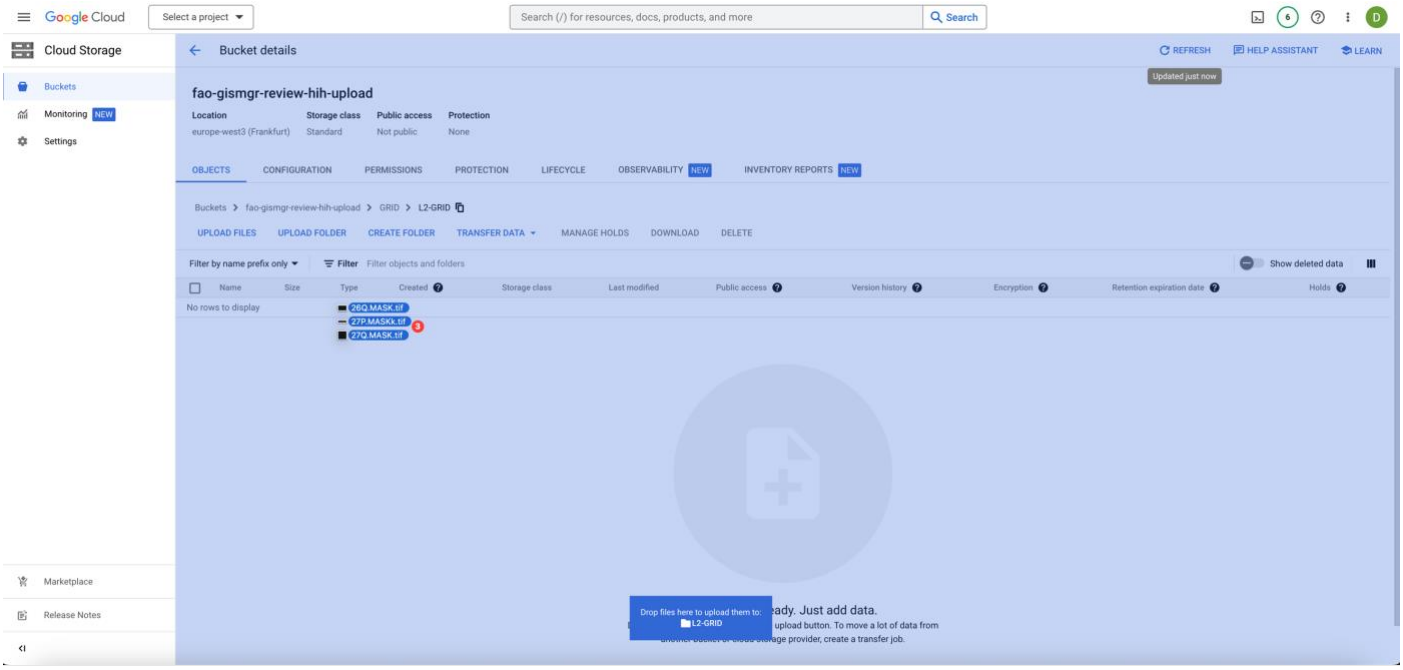

Figure 65 - Upload Grid Tiles.

When the process finishes, a new tab, Tiles, will appear in the Grid detail page. Selecting this tab, all uploaded tiles, with their metadata, will be displayed.

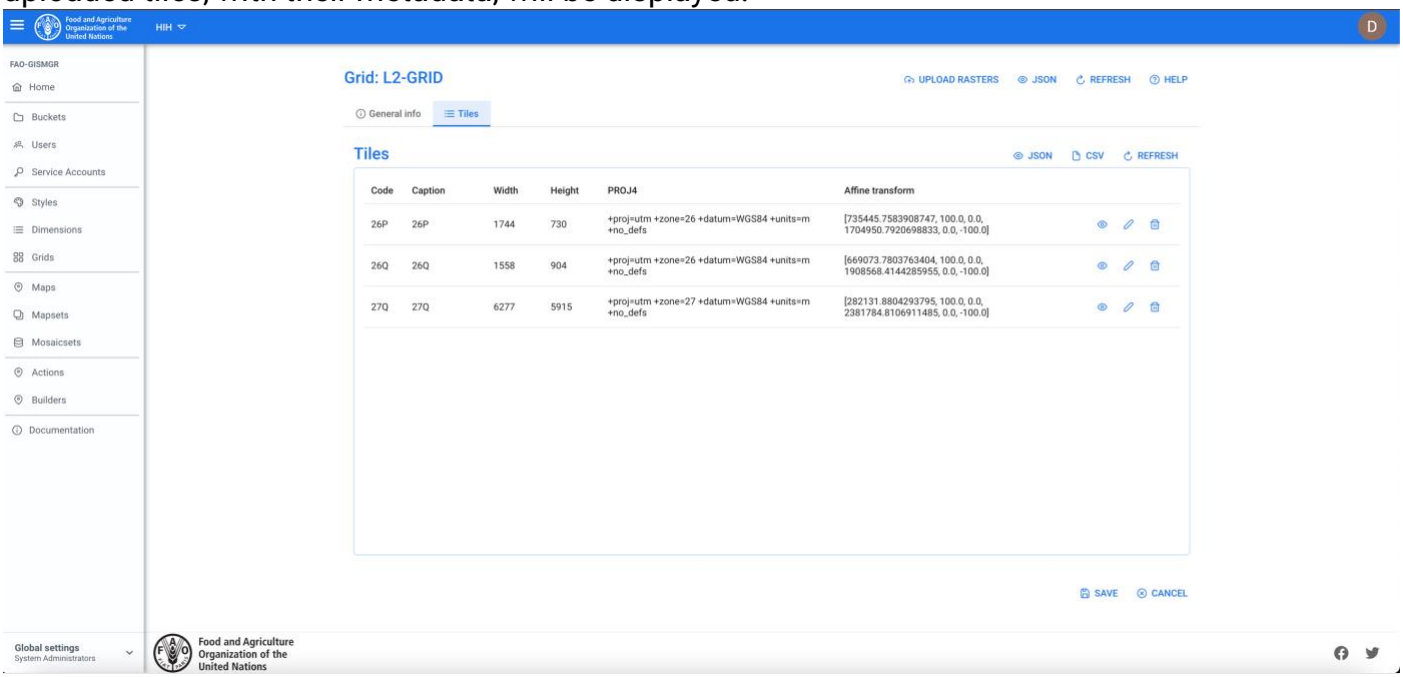

Figure 66 - List Grid Tiles.

9.4.1 View a Grid Tile

When one or more rasters have been uploaded, the tab Tiles appears. Selecting this tab, the system displays the list of rasters uploaded for the selected Grid. To view the metadata of a raster, the User must press corresponding eye button on the list.

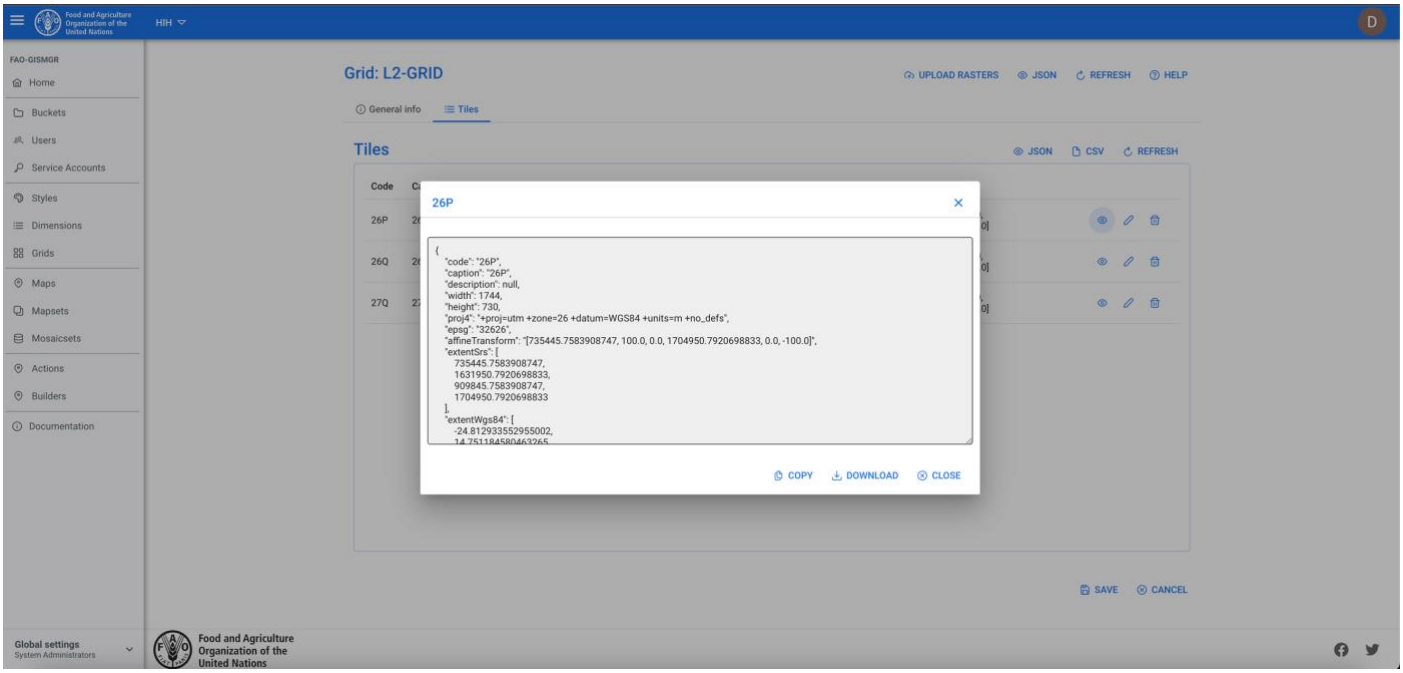

Figure 67 - View a Grid Tile.

9.4.2 Edit a Grid Tile

To edit a Tile, the User must press the edit button (pencil) of the corresponding Tile in the list. Update the updatable information and press save.

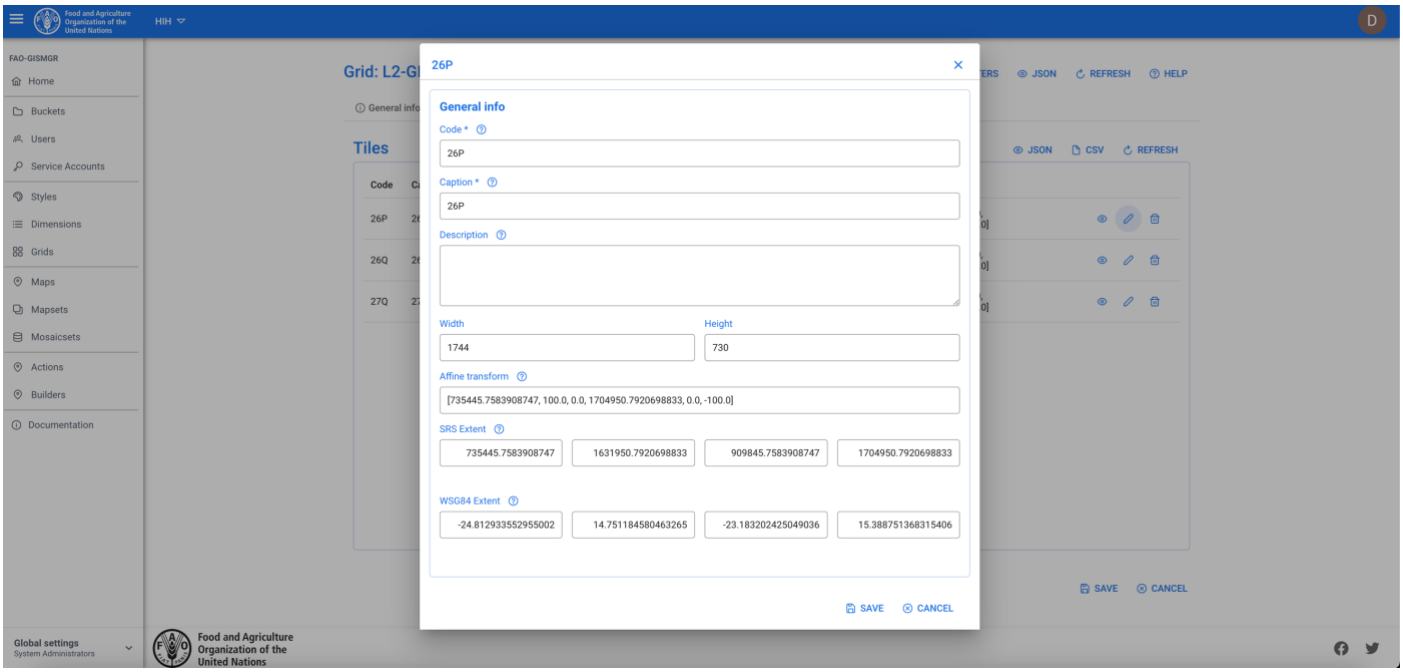

Figure 68 - Edit a Grid Tile.

9.4.3 Delete a Grid Tile

To delete a tile, the User must press the delete button (bin) of the corresponding Tile in the list. The system will display the deletion confirmation popup message. The User must choose ok to confirm deletion or cancel to cancel the operation. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

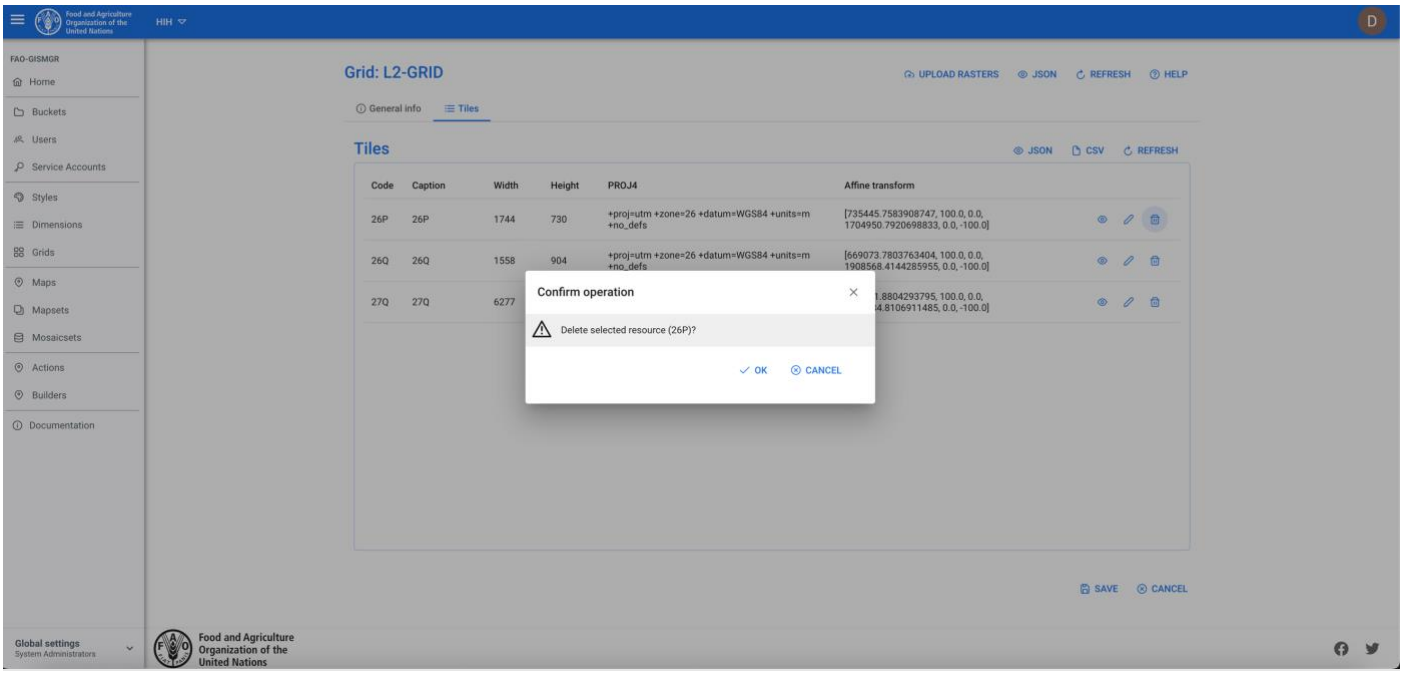

Figure 69 - Delete a Grid Tile.

9.5 Delete a Grid

The User must press the Grids button from the left menu. The system will display the list of all Grids for the selected Workspace. To delete a Grid, the User must press the corresponding delete button. The system will display the deletion confirmation popup message. The User must choose ok to confirm deletion or cancel to cancel the operation.

If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

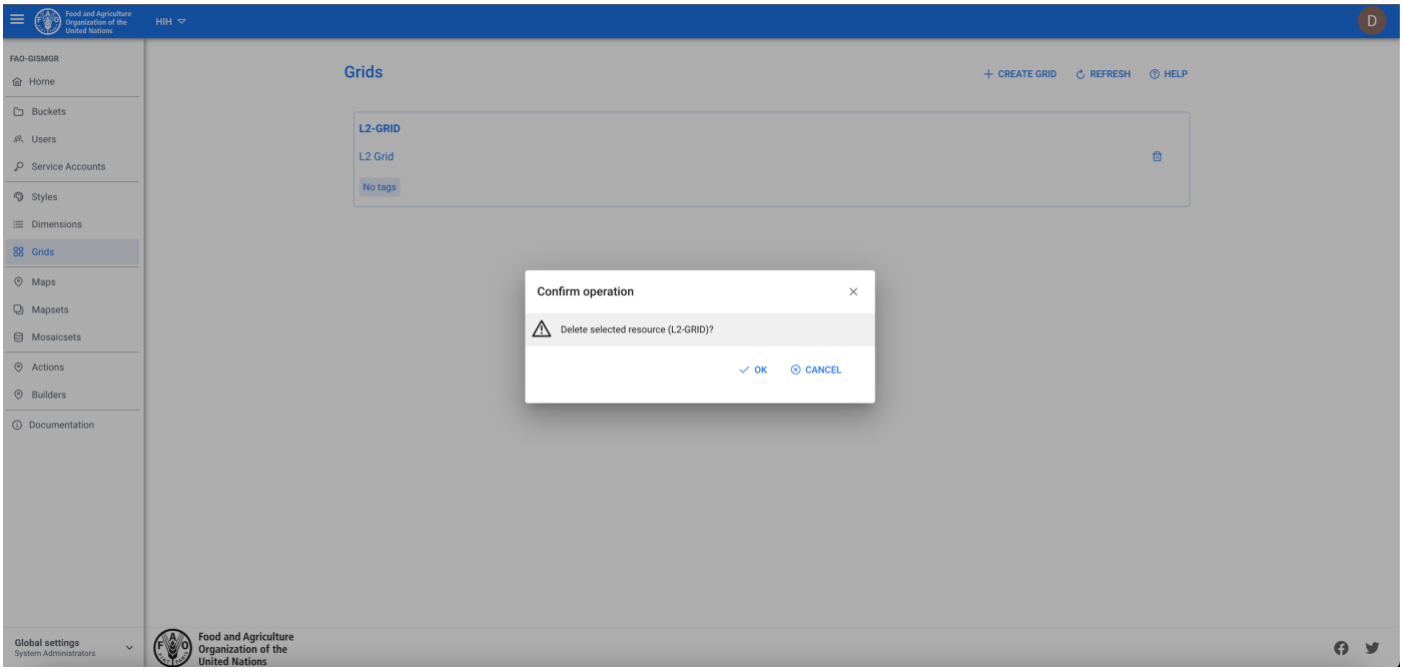

Figure 70 - Delete a Grid.

10 Mapsets

A Mapset is a set of maps (raster files) used to represent georeferenced data (facts) along one or mode dimensions of interest. In other words, a Mapset is an organized multidimensional set of data that measures a phenomenon. An example could be evapotranspiration in Africa from 2009 to 2023, or crop production over time.

As per maps, GISMGR handles different input formats, continuous or categorized rasters; input data is translated to COG format and finally stored/shared (with the related metadata as JSON files) on the workspaces' DATA buckets.

FIELD	DESCRIPTION
workspaceCode	string: unique code of the workspace to which the resource belongs. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
code	string: unique identifier of the resource. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
caption	string: a title or brief explanation of the resource. cannot be null; length must be min=3 and max=128; all characters except line breaks are allowed.
description	string: full or long explanation of the resource. can be null or empty;
dimensions	array: list of strings (workspaceCode:dimensionCode) representing the dimension/s that form the cube. at least 1 dimension must be specified.
defaultStyleCode	string: unique code of a previously defined style that must be applied for rendering the map's raster file. can be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
extensions	array: list of strings representing the expected raster dataset extensions. raster data can be formed by one or more files; set the expected extensions of the files that represent the full raster data, putting as first extension the main one. cannot be null (expected one extension at least); if formed by two or more files the file names must differ only in the extension part.
measureCaption	string: a title or brief explanation of the phenomenon being observed. can be null or empty
measureUnit	string: unit symbols of measurement. unit symbols are typically shortened versions of the unit name. can be null or empty; if the raster represents classes or categories unit value must be set equal to "class"

scale	double: slope of the slope-intercept form of linear equation to be applied to pixel value to get the actual value. cannot be null; default 1;
offset	double: intercept of the slope-intercept form of linear equation to be applied to pixel value to get the actual value. cannot be null; default 0;

flags	object: a JSON object representing pixel values with specific meaning.
	can be null; if provided for each pixel value the caption is mandatory, while description is optional.
	
	example:
	{
	"250": {
	"caption": "off season"
	},
	"251": {
	"caption": "no seasonality",
	}
	"253": {
	"caption": "insufficient data",
	}
	"254": {
	"caption": "no cropland / no grassland",
	}
	}

classes	object: a JSON object representing pixel values and their meaning.
	must be provided only if the measureUnit=class; for each pixel value the caption is mandatory, while description is optional.
	
	example:
	{
	"1": {
	"caption": "Tree cover (dense) ",
	"description": "Tree cover with a canopy cover >70% and height exceeding 5m."
	},
	"4": {
	"caption": "Grassland",
	"description": "Mainly grass cover with woody vegetation, canopy cover <15%"
	},
	
	. . .
	
	"255": {
	"caption": "no data",
	"description": "no data"
	}
	}

dimensionMembers	object: describes the Rule/s (how to extract the value of a dimension member for the specific dimension from the file name of the raster to be uploaded) and the Lookup/s (how a value extracted applying a Rule maps to the actual value of the dimension member for the specific dimension). cannot be null.

	"dimensionMembers": {
	"rules": [
	{
	"regex": "^CMR_(\\d{4})_CROP-(CV|MZ|RI|SG)\\.tif$",
	"members": {
	"SHARED:YEAR": "$1",
	"EOSTAT:CROPS": "CROP-$2"
	}
	}
	],
	"lookUp": {
	"EOSTAT:CROPS": {
	"mz": "CROP-MZ",
	"ri": "CROP-RI"
	}
	}
	}

styleRules	array of StyleRule: describes how to apply a specific style for a specific combination of one or more dimension member values
	
	can be null.
	
	"styleRules": [
	{
	"members": {
	"EOSTAT:CROPS": [
	"CROP-CV"
	]
	},
	"styleCode": "CROP-YIELD-CASSAVA"
	}
	]

translate	array: list of TranslateItem that define the *input raster to COG* format conversion process.
	can be null or empty; if not provided the default one is applied:
	
	[
	{
	"format": "GTiff",
	"options": [
	"INTERLEAVE=BAND",
	"TILED=YES",
	"COMPRESS=LZW"
	]
	}
	]

additionalInfo	object: additional information about the resource. can be null; a freely structured JSON object provided by the data owner to better describe the resource
tags	array: list of string objects; can be null or empty; a **tag** is a keyword or term assigned to a piece of information to describe it.

Dimension members

FIELD	DESCRIPTION
rules	array: list of Rule objects; cannot b null, at least one has to be specified. "rules": [

	<pre>{
	"regex": "^CMR_(\\d{4})_CROP-(CV|MZ|RI|SG)\\.tif$",
	"members": {
	"SHARED:YEAR": "$1",
	"EOSTAT:CROPS": "CROP-$2"
	}
	}
	]</pre>

lookUp	object: a JSON object representing, for every dimension of the cube, the mapping between the input value (value retrieved from the file using the Regular Expression) and the actual value of the dimension.
	can be null.
	
	<pre>"lookUp": {
	"EOSTAT:CROPS": {
	"mz": "CROP-MZ",
	"ri": "CROP-RI"
	}
	}</pre>

Rule

FIELD	DESCRIPTION
regex	string: a regular expression to be applied to the name of the input raster files name in order to capture (capture group) the value/s of the dimension member/s the raster refers to. cannot be null; <pre>"regex": "^phe_(\d{2})(s|m|e)(1|2)\.tif$"</pre>

members	object: a JSON object representing the code of the dimension and the value extracted (capture group) from the raster file name using the regex. In this way we map the raster to the corresponding dimension/s value.
	
	cannot be null;
	
	<pre>"members": {
	"SHARED:YEAR": "20$1",
	"ACME:SEASON": "SEASON$3",
	"ACME:STAGE": "$2"
	}</pre>

StyleRule

FIELD	DESCRIPTION

members	object: a JSON object describing which style should be applied to a specific dimension member.
	
	<pre>"members": {
	"EOSTAT:CROPS": [
	"CROP-CV"
	]
	}</pre>

styleCode	string : unique code of a previously defined style that must be applied for rendering the map's raster file. can be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with a hyphen. `"styleCode": "CROP-YIELD-CASSAVA"`

Translate

FIELD	DESCRIPTION
subDataset	string : selects the name of the input sub-dataset. (some raster drivers, like NetCDF or HDF5, support multidimensional datasets)
band	string : selects an input band for output; bands are numbered from 1.
format	string : selects the output format (raster driver); use the short format/driver name; for the full list of supported raster drivers see here
dataType	string : forces the output raster bands to have a specific data type supported by the driver, which may be one of the following: • Byte • Int8 • UInt16 • Int16 • UInt32 • Int32 • UInt64 • Int64 • Float32 • Float64 • CInt16 • CInt32 • CFloat32 • CFloat64
noDataValue	string : assigns a specified no-data value to the output file. if you want to remove or avoid to assign a no-data value you can set this option equal to none. Note that this option will not update any pixel value.
scale	array : array of 4 elements (string): • src_min - input raster min value • src_max - input raster max value • dst_min - output raster min value • dst_max - output raster max value rescales the input pixel values from the range {src_min..src_max} to the {dst_min..dst_max} one
srs	string : assigns a specified projection to the output file the spatial reference systems (projection) can be expressed using an EPSG code or a PROJ.4 declaration string.

	examples: EPSG:4326 or +proj=longlat +datum=WGS84 +no_defs +type=crs
extent	array : array of 4 elements (string): • ulx - upper left corner x coordinate • uly - upper left corner y coordinate • lrx - lower right corner x coordinate • lry - lower right corner y coordinate sets/assigns the georeferenced bounds of the output file. Note this option does not cause reprojection.
gridSubWindow	array : array of 4 elements (string): • xoff - grid window's upper left corner x coordinate (0-indexed) • yoff - grid window's upper left corner y coordinate (0-indexed) • xsize - window's width size expressed in pixels • ysize - window's height size expressed in pixels selects a subwindow from the source image for copying based on pixel/line (column/row) location.
srsSubWindow	array : array of 4 elements (string): • ulx - window's upper left corner x coordinate • uly - window's upper left corner y coordinate • lrx - window's lower right corner x coordinate • lry - window's lower right corner y coordinate selects a subwindow from the source image for copying based on georeferenced coordinates expressed in the SRS of the input raster Note that the SRS window will be previously translated to grid coordinates.
options	array : array of elements expressed in the NAME=VALUE form, where: • NAME is the name of the creation option • VALUE is the selected value to be assigned to the option defines the creation options for the output file. Many formats/drivers have one or more creation options that can be used to control particulars about the output file created. For instance, the GeoTIFF driver supports creation options to control compression, and whether the file should be tiled. The creation options available vary by format driver, and some simple formats have no creation options at all. See Raster drivers format specific documentation for legal creation options for each format. For the full list of supported raster drivers see here

10.1 List all Mapsets

To list all Mapsets, after selecting a Workspace, the User must click the Mapsets button from the left menu. The system will display all Mapsets in the system, for the selected Workspace.

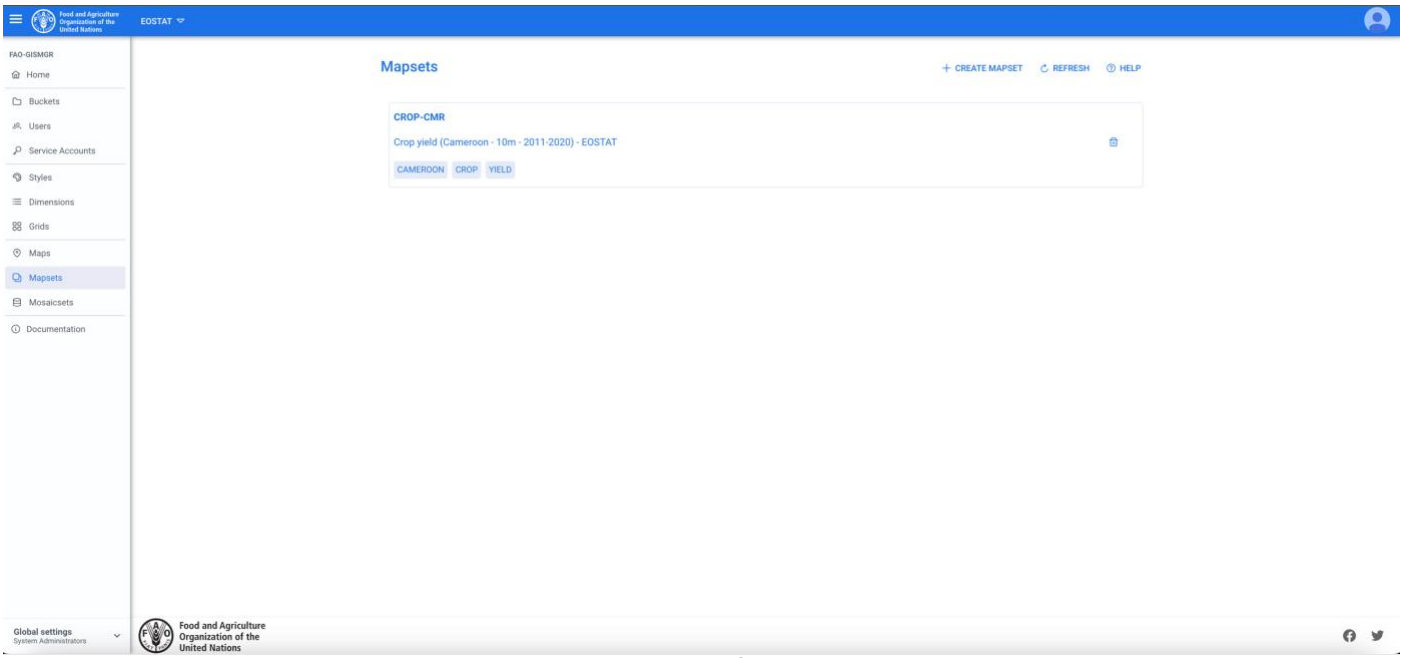

Figure 71 - List of Mapsets.

10.2 Create a Mapset

To create a new Mapset, after selecting a Workspace, the User must browse to the Mapsets page from the main menu. The system will display a list of the existing Mapsets. The User must press the Create Mapset button on the top right of the page, fill in the fields, the required ones being marked by an asterisk (*) and press the save button. If the operation is completed successfully, the system will display a confirmation message, otherwise it will display the error message.

Since a Mapset has many of fields to be defined, the interface has been divided in 3 tabs:

- **General info:** contains the main metadata, like code, caption, style, tags and the definition, through the dimensions, of the structure of the Mapset
- **Import info:** this part contains the information the system needs in order to process the data (raster files), applying optional translates, and relate them to the specific dimensions and styles
- **Rasters:** once the definition of the Mapset is completed and saved, it is possible to upload raster files. The list of raster files will appear in this tab, from which it is possible to view the metadata of a raster and eventually delete it.

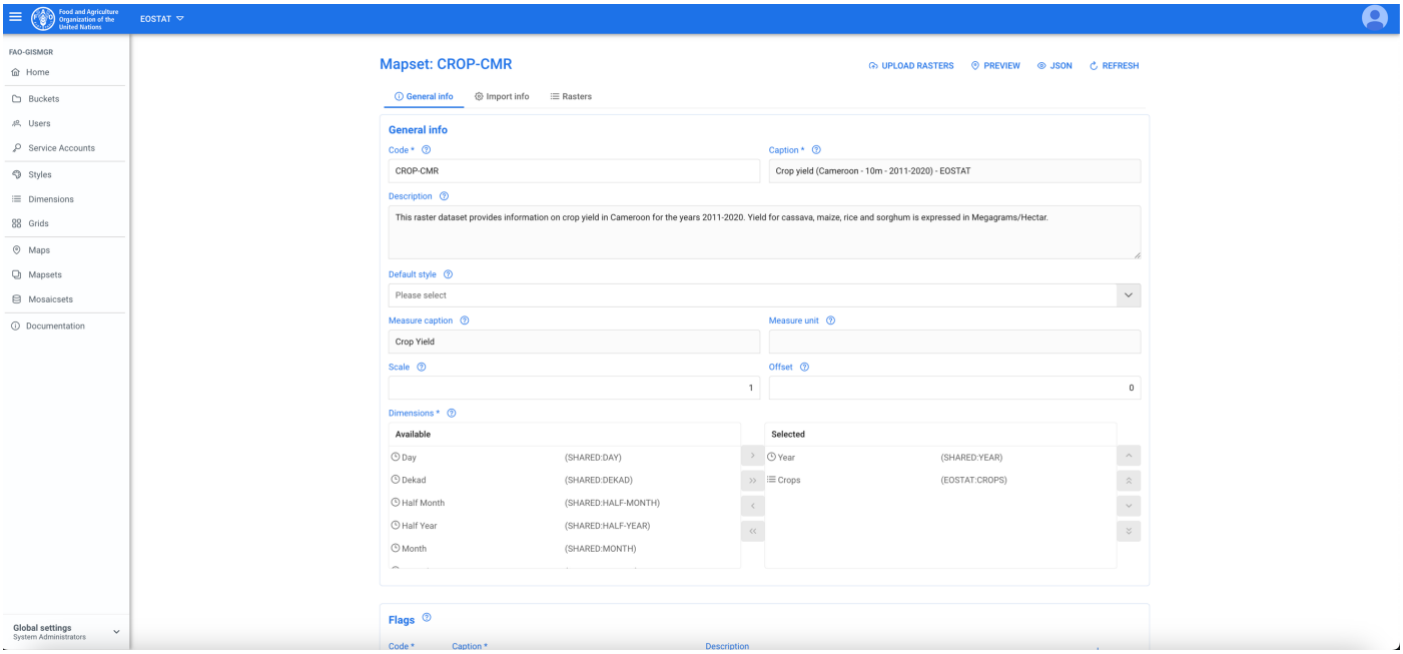

Figure 72 - Create a new Mapset.

10.2.1 Create a Mapset – General info

The General info of the Mapset allows to specify the code, caption and description of a Mapset, the first 2 being mandatory. The User can then define the default Style, the measure caption and unit, the scale and offset. After that, the User must define the Dimensions. The system will display a list of available Dimensions from both the SHARED Workspace and from the current Workspace. By double clicking on a Dimension from the left list (Available), this Dimension will be selected and moved to the selected dimensions on the right (Selected). It is possible also to deselect a dimension (by double clicking on its name in the selected dimensions list or selecting it and then pressing the left arrow button in the panel) or to change the order of dimensions using the up/down arrows in the Dimension select box.

Note: *if a time dimension is present, it must always be the first in the list.*

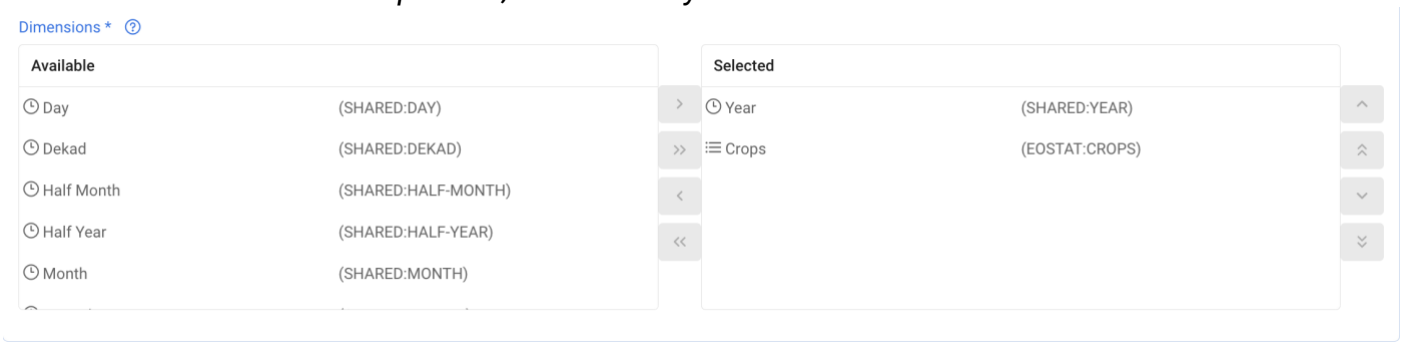

Figure 73 - Mapset, managing Dimensions.

10.2.2 Create a Mapset – Import info

Once the all the required information has been provided and validated in the General info tab, the User can proceed to the Import info tab to define how the system should import the data (raster files). This tab has 5 sections:

1. File info
2. Dimension members

3. Lookup
4. Style rules
5. Translate

10.2.2.1 File info

The User must enter the file extensions of the raster files that will be uploaded. The User must type the extension using the dot (.tif, .nc) and either press enter or tab or simply move to the following filed. The entered extension will appear highlighted in blue.

Figure 74 - Mapset, file extensions info.

10.2.2.2 Dimension members

This section instructs the system on how to deal with the files that will be imported and how they relate with the structure of the Mapset that has been defined in the previous tab (General info). For example, if a Mapset has two dimensions, Year and Crop, the system will display an input form with 3 input fields: one for the regular expression, one for the year dimension and one for the crop dimension. Below an example.

We have a list of files:
CMR_2011_CROP-CV.tif
CMR_2012_CROP-CV.tif
CMR_2013_CROP-CV.tif
CMR_2014_CROP-CV.tif
CMR_2011_CROP-MZ.tif
CMR_2012_CROP-MZ.tif
CMR_2013_CROP-MZ.tif
CMR_2014_CROP-MZ.tif
CMR_2011_CROP-RI.tif
CMR_2012_CROP-RI.tif
CMR_2013_CROP-RI.tif
CMR_2014_CROP-RI.tif
CMR_2011_CROP-SG.tif
CMR_2012_CROP-SG.tif
CMR_2013_CROP-SG.tif
CMR_2014_CROP-SG.tif

From very file, according to the Mapset definition, the system needs to extract the year (Year Dimension) and the Crop (Crop Dimension). In our Crop Dimension, we have defined the possible values: CROP-CV (Cassava), CROP-MZ (Maize), CROP-RI (Rice) and CROP-SG (Sorghum).
The regular expression to extract this information would be:

Regular expression: *^CMR_(\d{4})_CROP-(CV|MZ|RI|SG)\.tif$*
***Year dimension** (SHARED:YEAR):* *$1*
***Crop dimension** (EOSTAT:CROPS):* *CROP-$2*

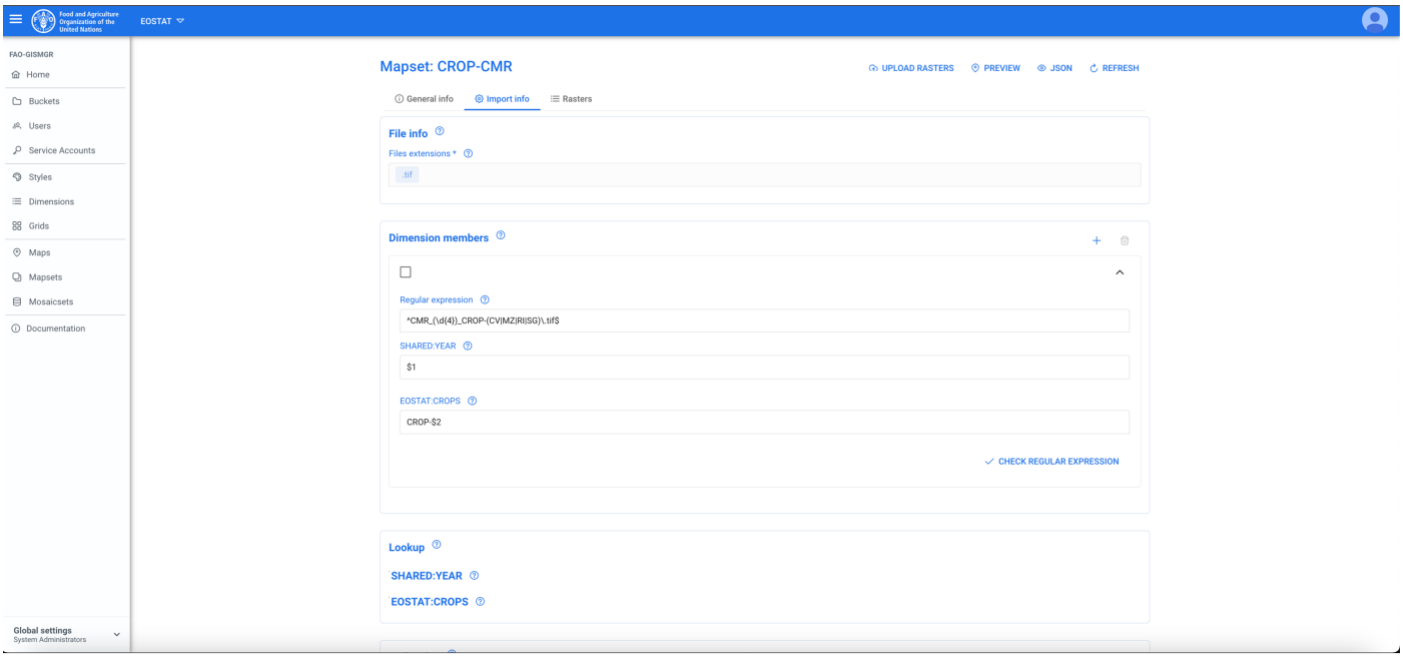

Figure 75 - Mapset, define Dimension Members.

The text between brackets *(\d{4})* and *(CV|MZ|RI|SG)* are the "groups" of information we want to catch, so here we have 2 group, *$1* and *$2*. Group *$1* will capture the year, while group *$2* the crop but, since the code for our crops, as defined in the dimension, are CROP-CV and not CV, we prepend CROP- to the catching group.

Below an example (*https://regex101.com/r/AleoTl/1*).

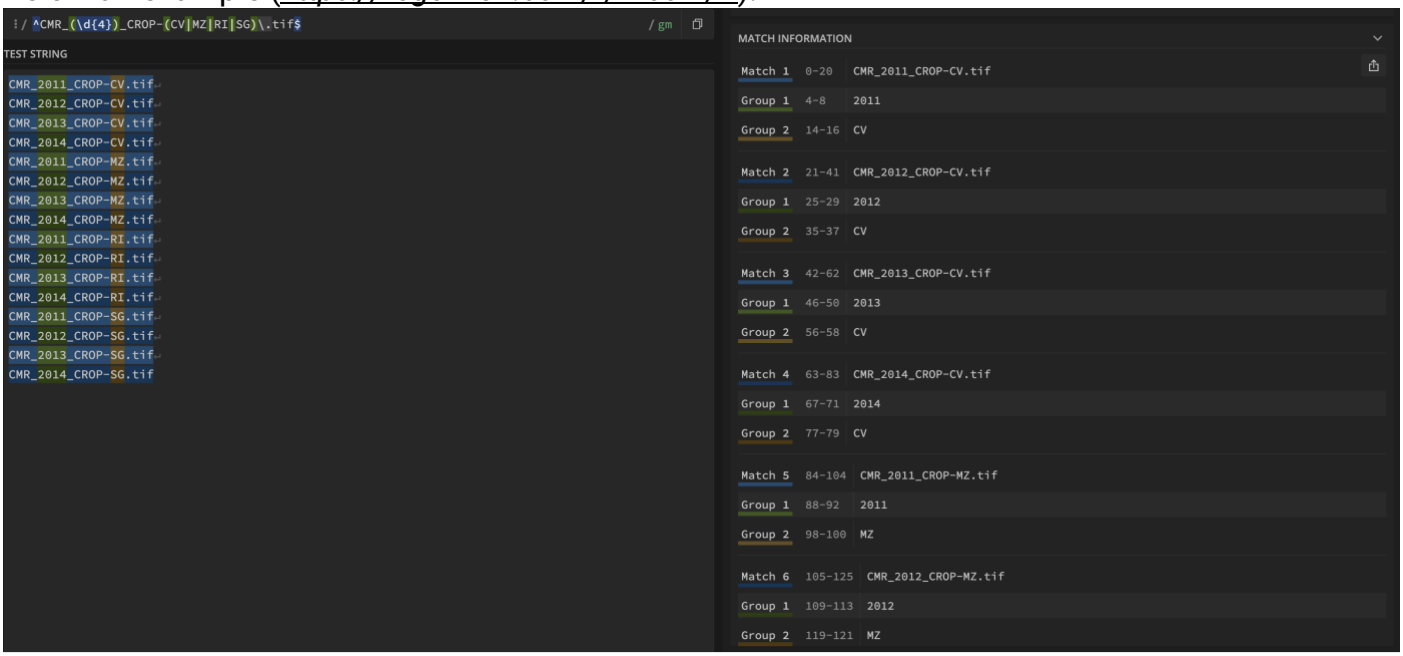

Figure 76 - Mapset, regular expression example.

To validate the Regular expression in the system, the User must press the Check regular expression button and insert the name of a raster file. The User must then press the validate button. The system will show how the values extracted from the file name map to the dimensions.

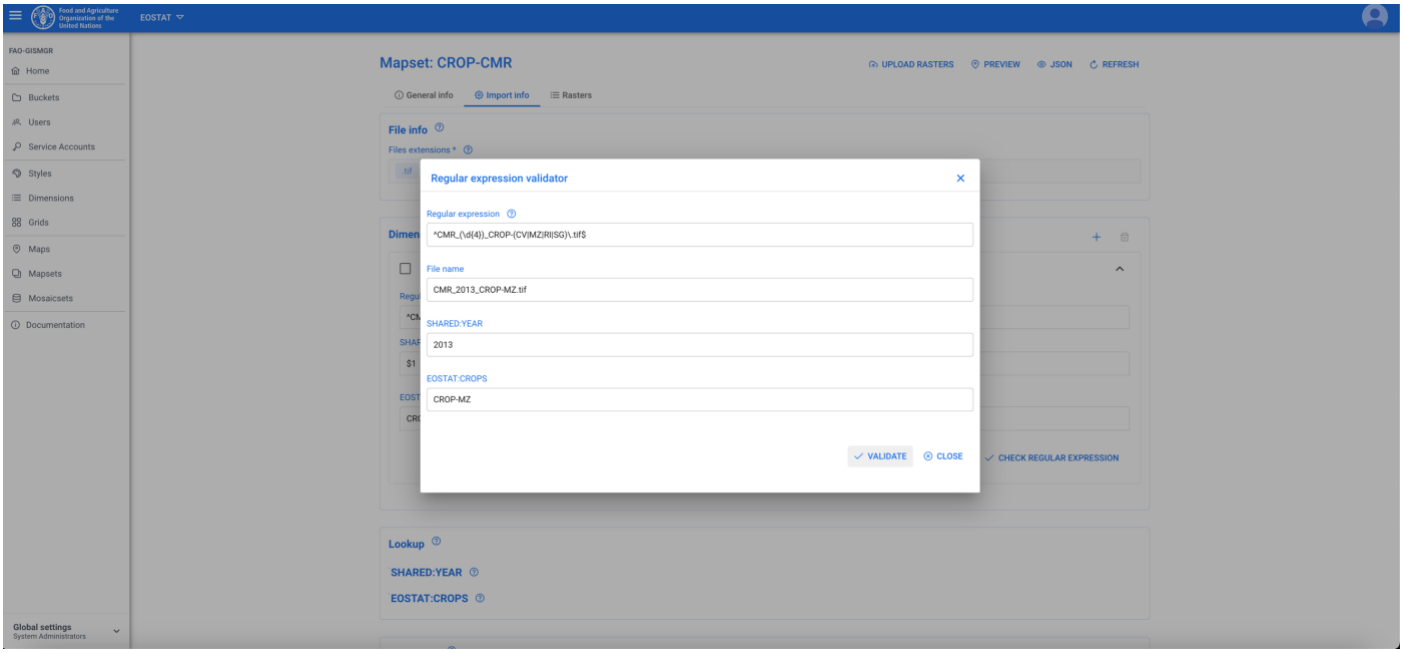

Figure 77 - Mapset, validate a regular expression.

It is possible, if necessary, to define more than one rule (pressing the + button on the dimension member box) if one does not capture all possible values of the files to be uploaded.
Note: *the order of the dimension members rule is important: if the first rule is looser, and captures all the possible values of a file name, the rules following will never be evaluated.*

10.2.2.3 Lookup

In the Lookup box, the system will display the dimensions that have been selected for the Mapset by displaying their code (workspaceCode:dimensionCode). To enter a Lookup, the User must press the + button on the right side of the desired dimension. The system will open a popup where to enter as **key** the value extracted by the regular expression for that dimension, as value the corresponding actual value among the dimension members of the dimension.

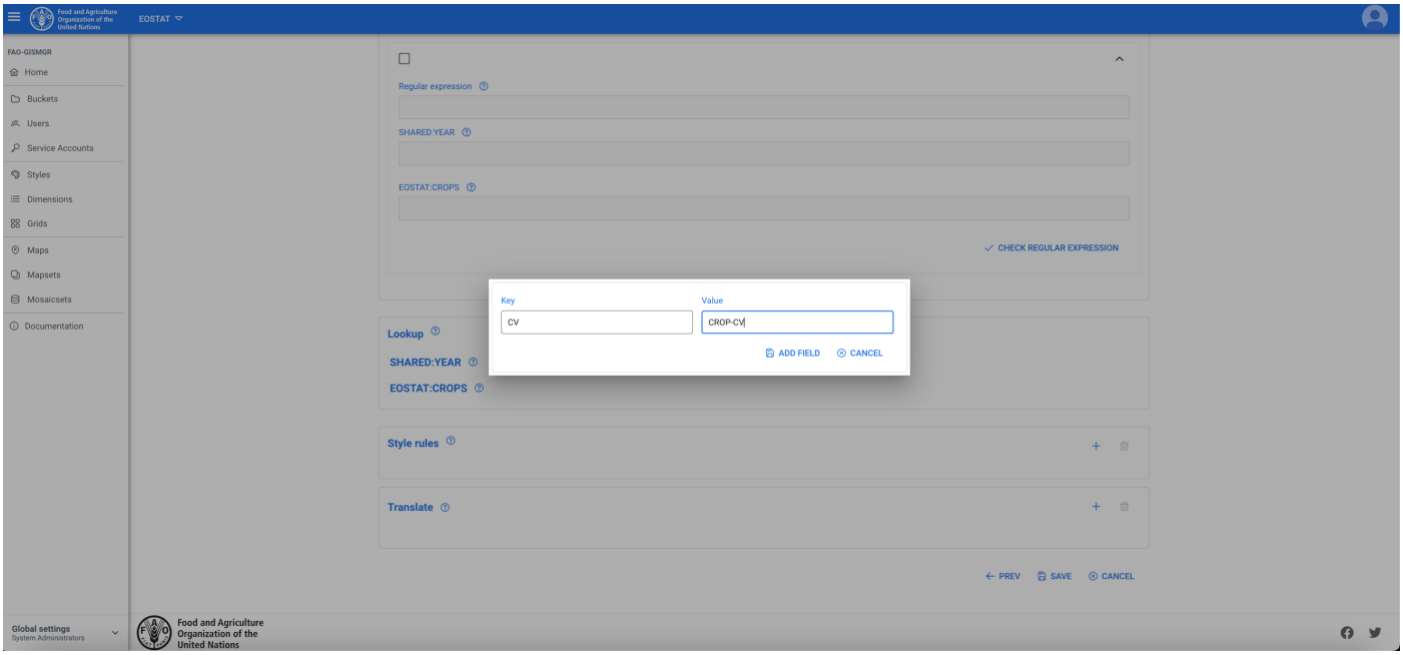

Figure 78 - Mapset, adding a Lookup.

10.2.2.4 Style rules

It is possible to assign a specific Style to a specific raster. To specify a style rule, the User must press the + button on the top right of the Style rule box. The system, similarly to the lookup box, will display the dimensions that have been selected for the Mapset by displaying their code (workspaceCode:dimensionCode). For the desired dimension/s (the others can be left null), the User must add the list of values (pressing tab or enter) of the raster and then select the style for those values from the dropdown list below. It is possible to define zero or more lookups for every Mapset.

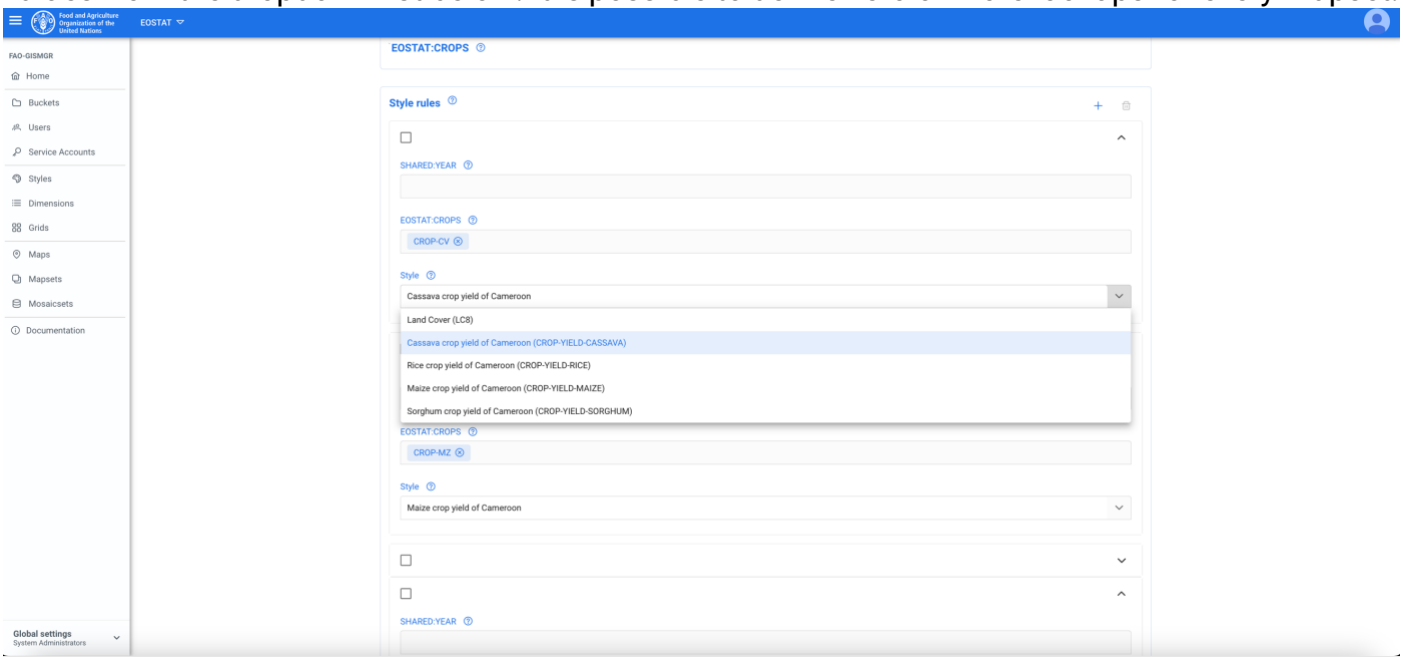

Figure 79 - Mapset, defining a Style Rule.

10.2.2.5 Translate

The Translate/s is optional. If no translate is inserted, the system will automatically add a translate that transforms the uploaded file into a COG (-of GTiff INTERLEAVE=BAND -co TILED=YES -co COMPRESS=LZW).

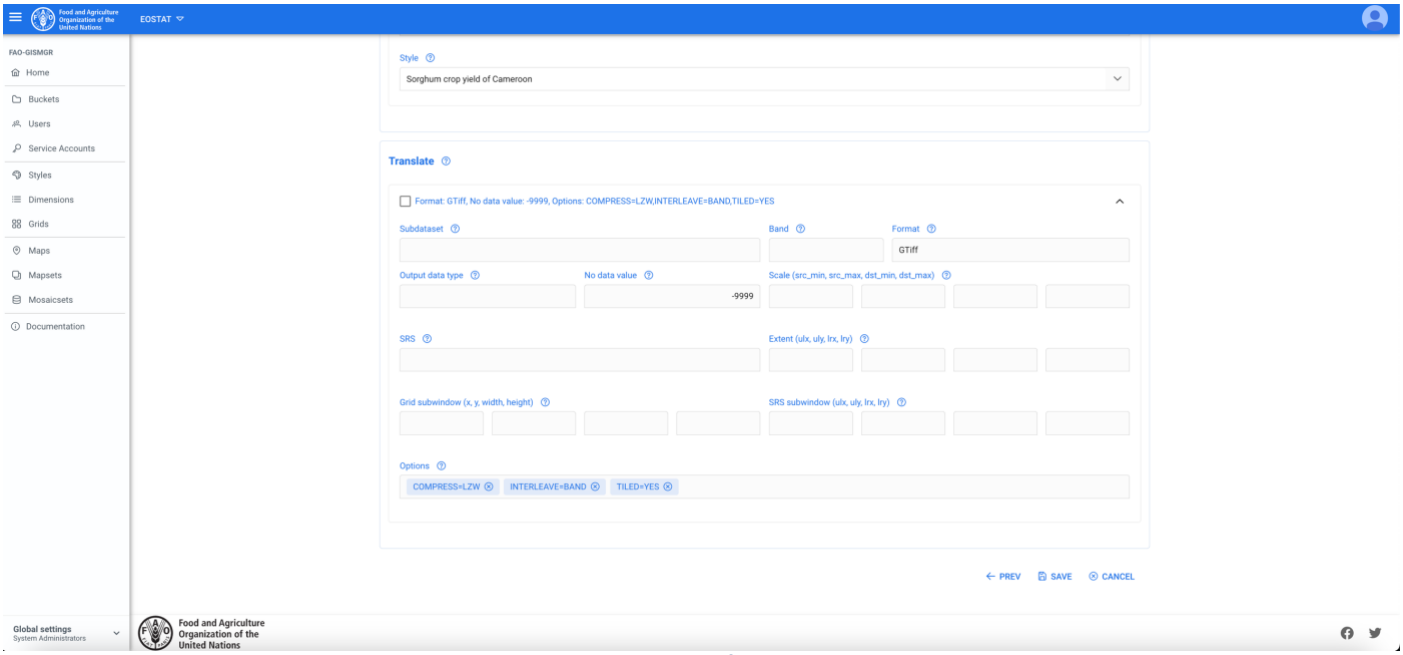

Figure 80 - Mapset, defining a Translate.

10.2.3 Create a Mapset – Rasters

Once a Mapset is saved, it is possible to upload the raster files. The list of raster files will be visible in the Rasters tab, from where the User can see, the metadata (geospatial info) of a raster file and eventually delete a raster file.

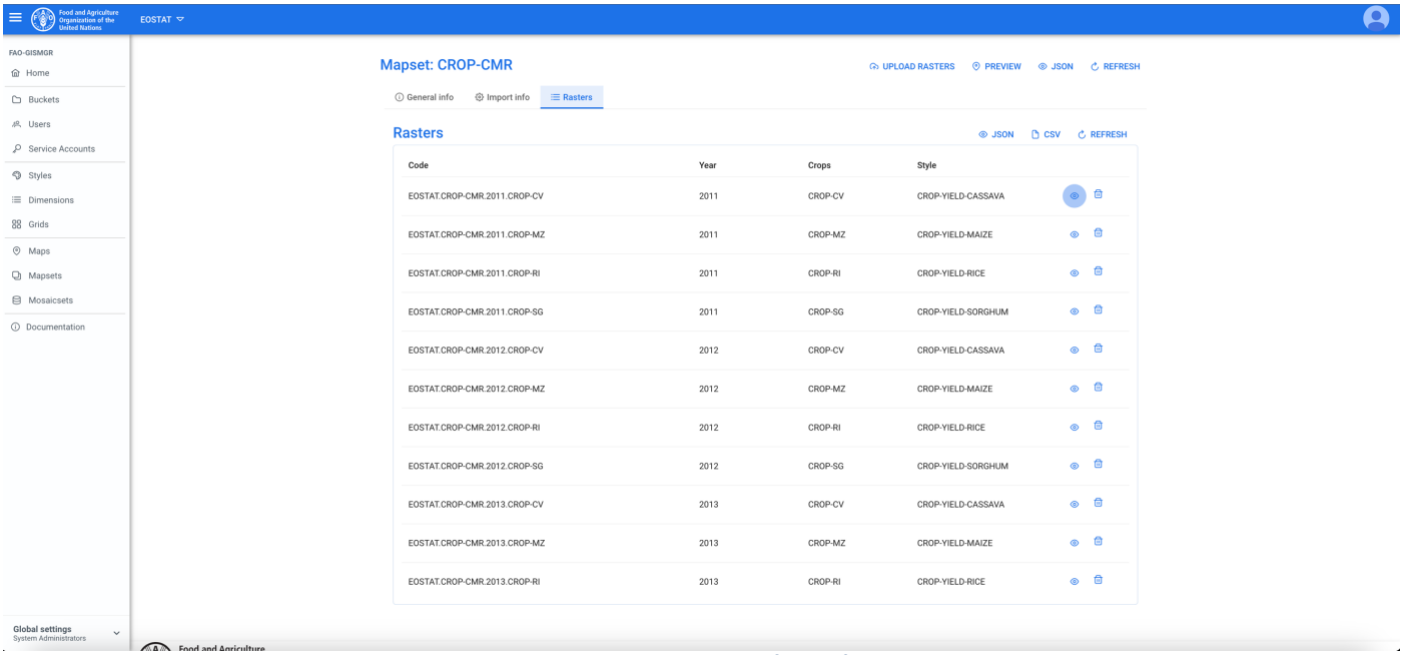

Figure 81 - Mapset, list of rater files.

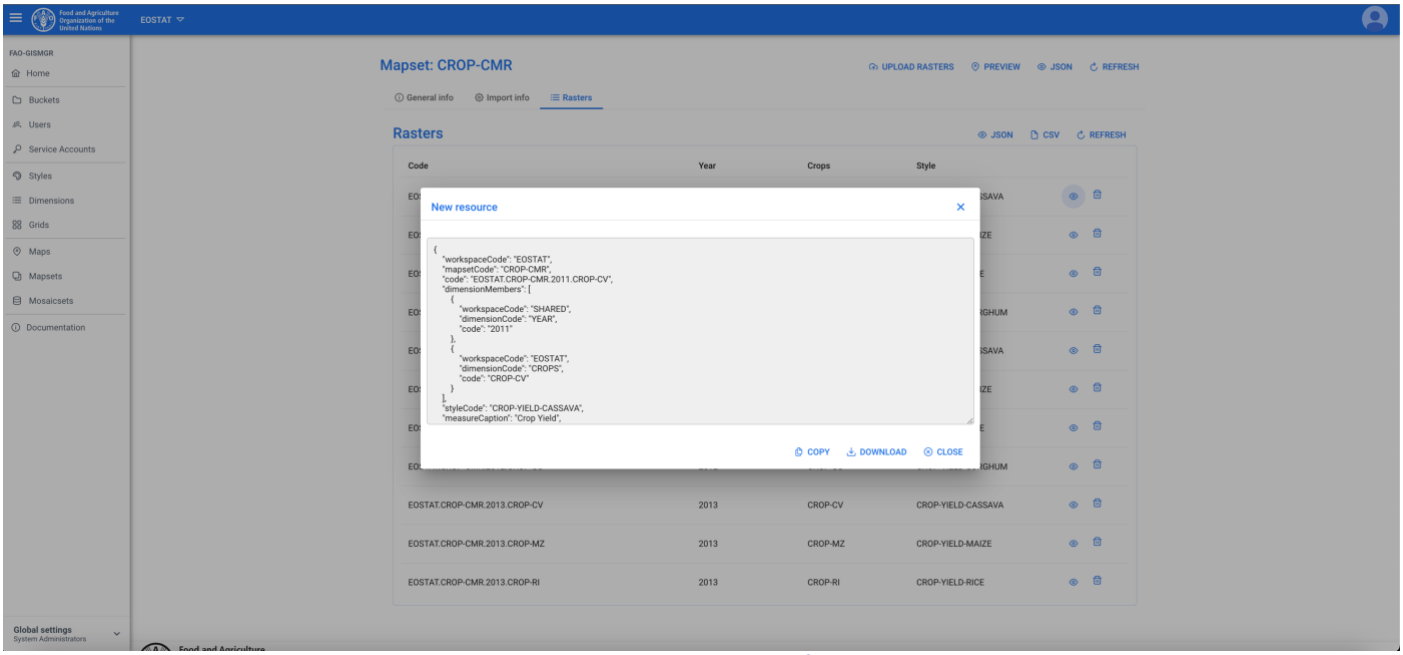

Figure 82 - Mapset, view a raster file metadata.

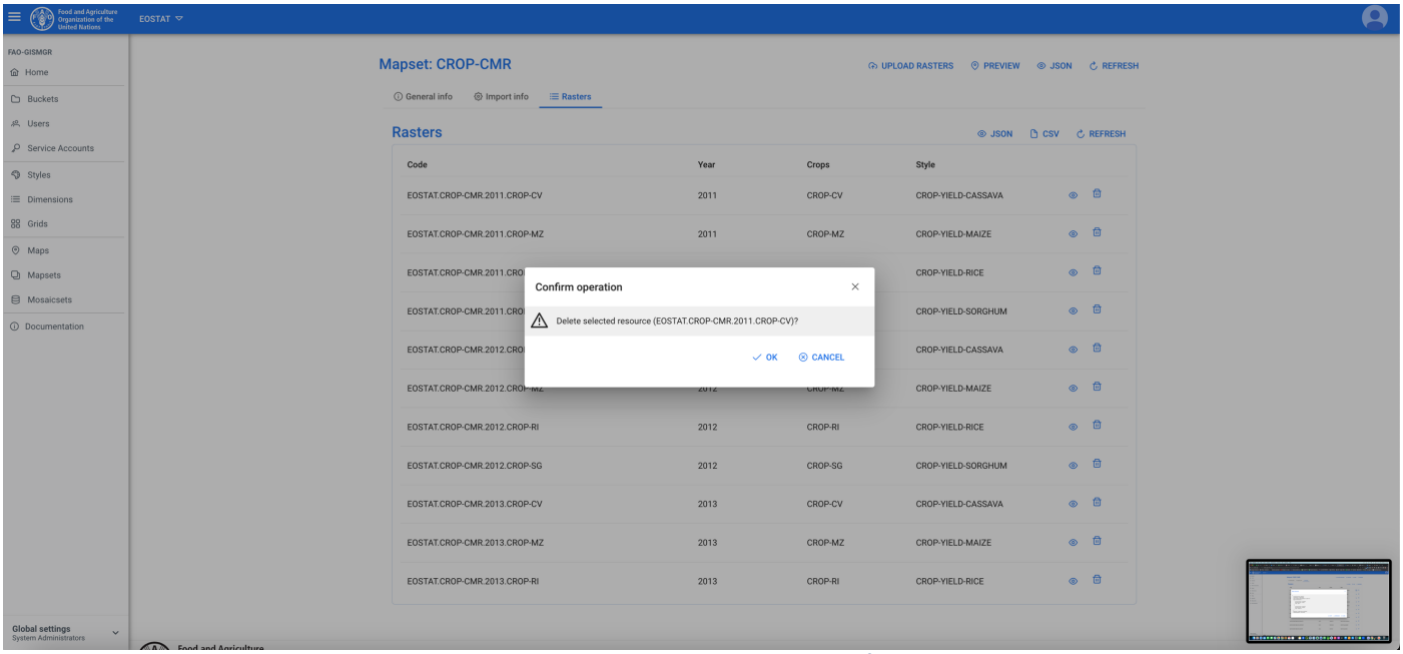

Figure 83 - Mapset, delete a raster file.

10.3 Update a Mapset

To update a Mapset, the User must select an existing Mapset from the list of Mapsets by clicking/tapping on the desired one. The system will display the selected Mapset input form to update the data. Once completed, the User must press the save button to save the changes. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message. The fields of the Mapset can be updated according to the following table:

Field name	Updatable
General info - Code	No
General info - Caption	Yes
General info - Description	Yes
General info - Default style code	Yes
General info - Measure caption	Yes
General info - Measure unit	Yes
General info - Scale	Only if no rasters have been uploaded
General info - Offset	Only if no rasters have been uploaded
General info - Dimensions	No
General info - Flags	Yes
General info - Tags	Yes
General info - Additional info	Yes
Import info – File extensions	Only if no rasters have been uploaded
Import info – Dimension members	Only if no rasters have been uploaded
Import info – Lookup	Only if no rasters have been uploaded
Import info – Style rules	Only if no rasters have been uploaded
Import info –Translate	Only if no rasters have been uploaded

10.4 Upload a raster file/s

Once the metadata for the Mapset has been created/updated, the User can upload, to the upload bucket, the file/files that constitute the Mapset. The User must browse to the Upload bucket or click the Upload button on the top right of the Mapset detail window. The bucket page will open in the browser. The User must drag the file/s onto the bucket and the upload will start. Once the file is uploaded, the system will process the file/s to publish the Mapset.

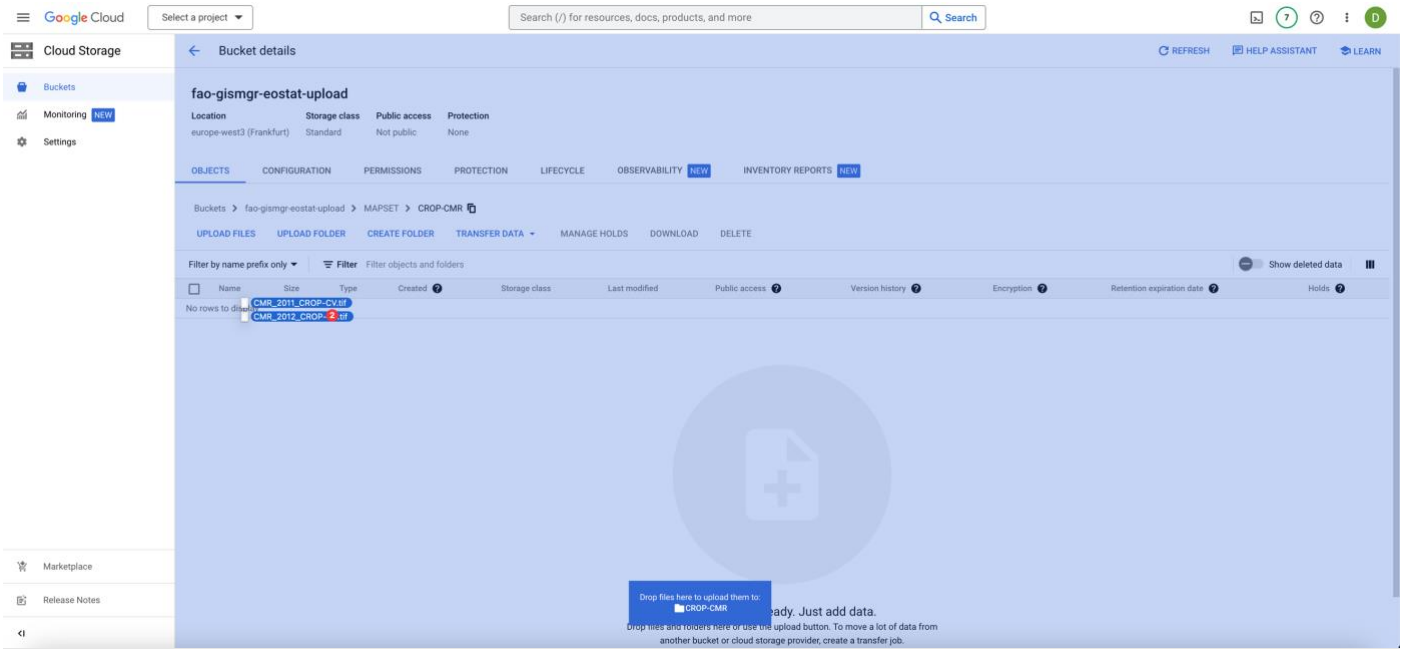

Figure 84 - Mapset, upload raster files.

10.5 Preview a Mapset

When the selected Workspace data bucket is PUBLIC, when a Mapset is created and the relative raster/s file/s have been uploaded to the Upload bucket and processed successfully, the system will display a Preview button. The User must press the button to be redirected to a page with the Mapset preview. From this page it is possible to select the different raster/s available (selecting different values for the available dimensions), view the metadata and the legend.

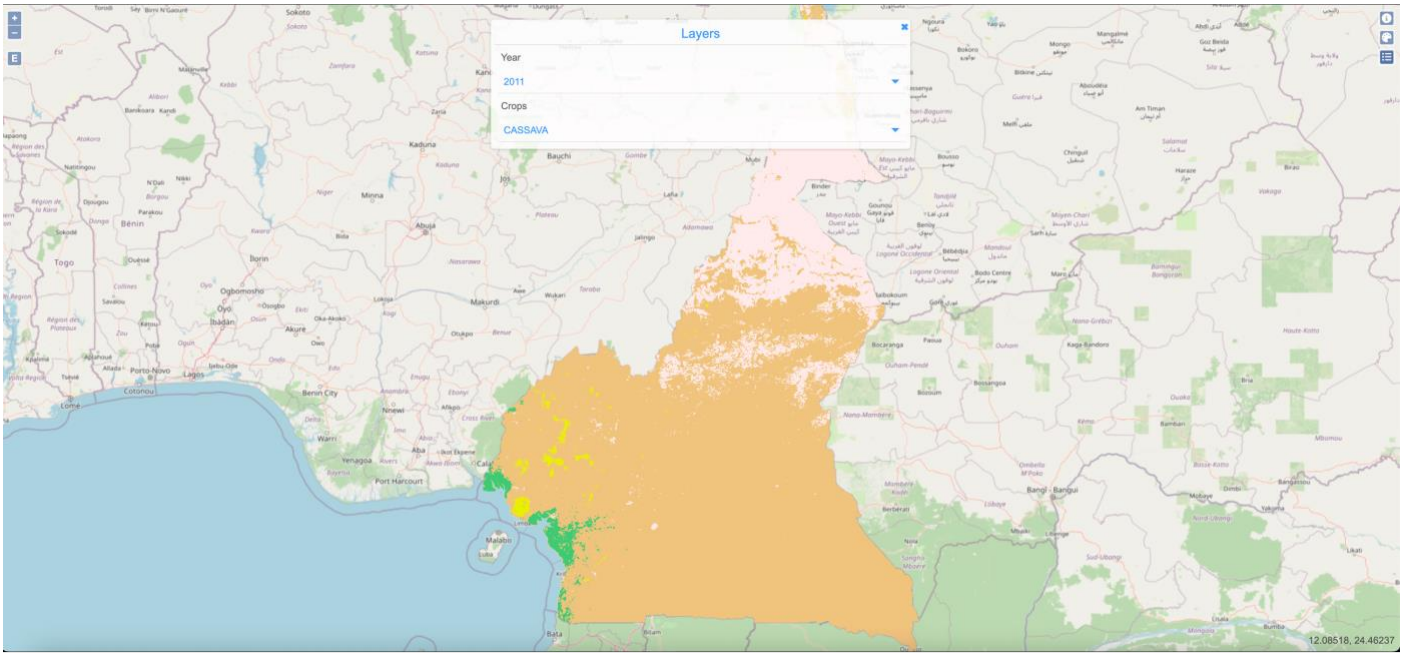

Figure 85 - Mapset preview.

10.6 Delete a Mapset

The User must press the Mapset button from the left menu, after selecting a Workspace. The system will display the list of all Mapsets for the selected Workspace. To delete a Mapset, the User must press the corresponding delete button. The system will display the deletion confirmation popup message. The User must choose ok to confirm deletion or cancel to cancel the operation. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

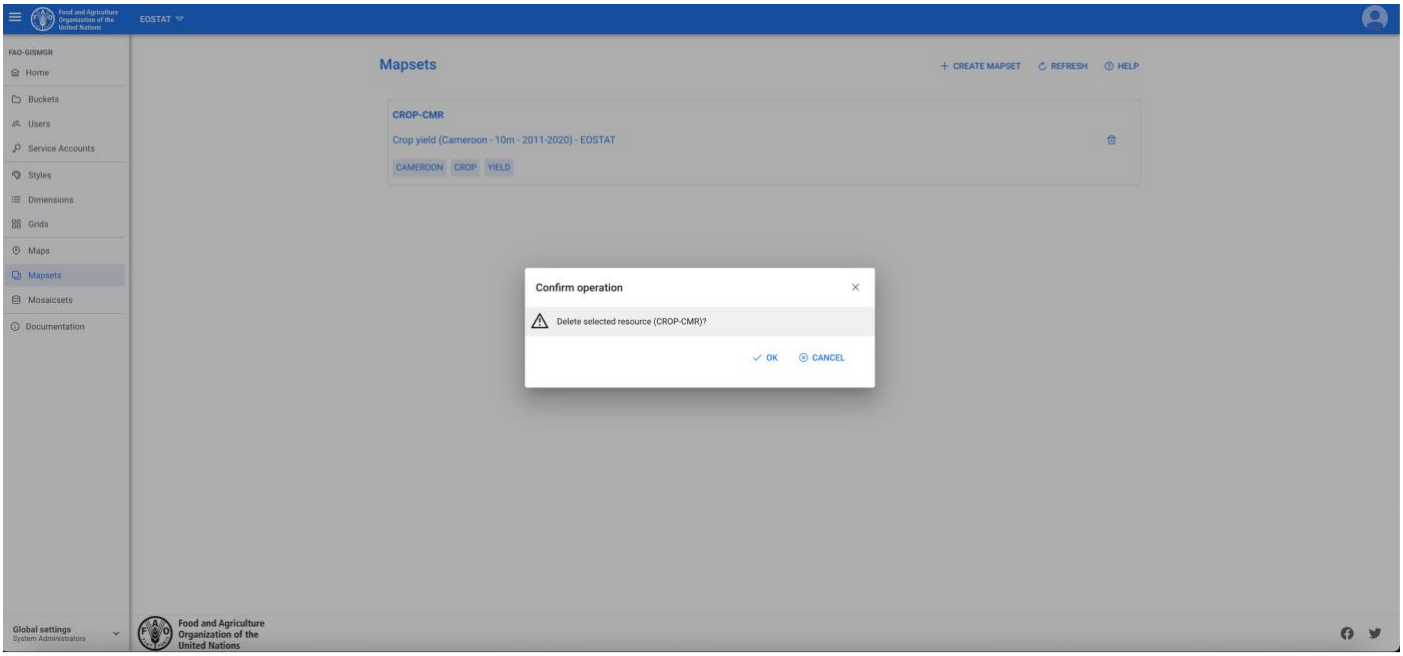

Figure 86 - Delete a Mapset.

11 Mosaicsets

A Mosaicset, similar to the Mapset, is a set of maps (raster files) used to represent georeferenced data (facts) along one or mode dimensions of interest. In addition to the dimensions, a Mosaicset has also a Grid, which we can consider a sort of geographical dimension. As an example, we could have a Mosaicset representing Evaporation with a Grid that represents UTM zones of the world and a time Dimension that represents the year of observation.

As per maps, GISMGR handles different input formats, continuous or categorized rasters; input data is translated to COG format and finally stored/shared (with the related metadata as JSON files) on the workspaces' DATA buckets.

FIELD	DESCRIPTION
workspaceCode	string: unique code of the workspace to which the resource belongs. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
code	string: unique identifier of the resource. cannot be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
caption	string: a title or brief explanation of the resource. cannot be null; length must be min=3 and max=128; all characters except line breaks are allowed.
description	string: full or long explanation of the resource. can be null or empty;
gridCode	string: unique code of a previously defined grid. can be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
dimensions	array: list of strings (workspaceCode:dimensionCode) representing the dimension/s that form the cube. at least 1 dimension must be specified.
defaultStyleCode	string: unique code of a previously defined style that must be applied for rendering the map's raster file. can be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with an hyphen
extensions	array: list of strings representing the expected raster dataset extensions. raster data can be formed by one or more files; set the expected extensions of the files that represent the full raster data, putting as first extension the main one. cannot be null (expected one extension at least); if formed by two or more files the file names must differ only in the extension part.
measureCaption	string: a title or brief explanation of the phenomenon being observed. can be null or empty

measureUnit	string: unit symbols of measurement. unit symbols are typically shortened versions of the unit name. can be null or empty; if the raster represents classes or categories unit value must be set equal to “class”
scale	double: slope of the slope-intercept form of linear equation to be applied to pixel value to get the actual value. cannot be null; default 1;
offset	double: intercept of the slope-intercept form of linear equation to be applied to pixel value to get the actual value. cannot be null; default 0;
flags	object: a JSON object representing pixel values with specific meaning. can be null; if provided for each pixel value the caption is mandatory, while description is optional. **example:** `{ "250": { "caption": "off season" }, "251": { "caption": "no seasonality", } "253": { "caption": "insufficient data", } "254": { "caption": "no cropland / no grassland", } }`

classes	object: a JSON object representing pixel values and their meaning.
	must be provided only if the measureUnit=class; for each pixel value the caption is mandatory, while description is optional.
	
	example:
	`{ "1": { "caption": "Tree cover (dense) ", "description": "Tree cover with a canopy cover >70% and height exceeding 5m." }, "4": { "caption": "Grassland", "description": "Mainly grass cover with woody vegetation, canopy cover <15%" },`
	
	`. . .`
	
	`"255": { "caption": "no data", "description": "no data" } }`

dimensionMembers	object: describes the Rule/s (how to extract the value of a dimension member for the specific dimension from the file name of the raster to be uploaded) and the

	Lookup/s (how a value extracted applying a Rule maps to the actual value of the dimension member for the specific dimension).
	
	cannot be null.
	
	"dimensionMembers": {
	"rules": [
	{
	"regex": "^CMR_(\\d{4})_CROP-(CV|MZ|RI|SG)\\.tif$",
	"members": {
	"SHARED:YEAR": "$1",
	"EOSTAT:CROPS": "CROP-$2"
	}
	}
	],
	"lookUp": {
	"EOSTAT:CROPS": {
	"mz": "CROP-MZ",
	"ri": "CROP-RI"
	}
	}
	}

styleRules	array of StyleRule: describes how to apply a specific style for a specific combination of one or more dimension member values
	
	can be null.
	
	"styleRules": [
	{
	"members": {
	"EOSTAT:CROPS": [
	"CROP-CV"
	]
	},
	"styleCode": "CROP-YIELD-CASSAVA"
	}
	]

translate	array: list of TranslateItem that define the *input raster to COG* format conversion process.
	can be null or empty; if not provided the default one is applied:
	
	[
	{
	"format": "GTiff",
	"options": [
	"INTERLEAVE=BAND",
	"TILED=YES",
	"COMPRESS=LZW"
	]
	}
	]

additionalInfo	object: additional information about the resource. can be null; a freely structured JSON object provided by the data owner to better describe the resource
tags	array: list of string objects; can be null or empty; a **tag** is a keyword or term assigned to a piece of information to describe it.

Dimension members

FIELD	DESCRIPTION

rules	array: list of Rule objects;
	cannot b null, at least one has to be specified.
	"rules": [
	{
	"regex": "^CMR_(\\d{4})_CROP-(CV|MZ|RI|SG)\\.tif$",
	"members": {
	"SHARED:YEAR": "$1",
	"EOSTAT:CROPS": "CROP-$2"
	}
	}
	]

lookUp	object: a JSON object representing, for every dimension of the cube, the mapping between the input value (value retrieved from the file using the Regular Expression) and the actual value of the dimension.
	can be null.
	"lookUp": {
	"EOSTAT:CROPS": {
	"mz": "CROP-MZ",
	"ri": "CROP-RI"
	}
	}

Rule

FIELD	DESCRIPTION
regex	string: a regular expression to be applied to the name of the input raster files name in order to capture (capture group) the value/s of the dimension member/s the raster refers to. cannot be null; "regex": "^phe_(\d{2})(s|m|e)(1|2)\.tif$"

members	object: a JSON object representing the code of the dimension and the value extracted (capture group) from the raster file name using the regex. In this way we map the raster to the corresponding dimension/s value.
	cannot be null;
	"members": {
	"SHARED:YEAR": "20$1",
	"ACME:SEASON": "SEASON$3",
	"ACME:STAGE": "$2"
	}

StyleRule

FIELD	DESCRIPTION
members	object: a JSON object describing which style should be applied to a specific dimension member. `"members": { "EOSTAT:CROPS": [ "CROP-CV" ] }`
styleCode	string: unique code of a previously defined style that must be applied for rendering the map's raster file. can be null; length must be min=3 and max=32; allowed characters can be capital letters (A-Z), digits (0-9), hyphen (-); cannot start and/or end with a hyphen. `"styleCode": "CROP-YIELD-CASSAVA"`

Translate

FIELD	DESCRIPTION
subDataset	string: selects the name of the input sub-dataset. (some raster drivers, like NetCDF or HDF5, support multidimensional datasets)
band	string: selects an input band for output; bands are numbered from 1.
format	string: selects the output format (raster driver); use the short format/driver name; for the full list of supported raster drivers see here
dataType	string: forces the output raster bands to have a specific data type supported by the driver, which may be one of the following: • Byte • Int8 • UInt16 • Int16 • UInt32 • Int32 • UInt64 • Int64 • Float32 • Float64 • CInt16 • CInt32 • CFloat32 • CFloat64
noDataValue	string: assigns a specified no-data value to the output file. if you want to remove or avoid to assign a no-data value you can set this option equal to none. Note that this option will not update any pixel value.
scale	array: array of 4 elements (string): • src_min - input raster min value

	• src_max - input raster max value • dst_min - output raster min value • dst_max - output raster max value rescales the input pixel values from the range {src_min..src_max} to the {dst_min..dst_max} one

srs	`string`: assigns a specified projection to the output file
	the spatial reference systems (projection) can be expressed using an EPSG code or a PROJ.4 declaration string.
	
	examples:
	`EPSG:4326`
	or
	`+proj=longlat +datum=WGS84 +no_defs +type=crs`

extent	`array`: array of 4 elements (string): • ulx - upper left corner x coordinate • uly - upper left corner y coordinate • lrx - lower right corner x coordinate • lry - lower right corner y coordinate sets/assigns the georeferenced bounds of the output file. Note this option does not cause reprojection.
gridSubWindow	`array`: array of 4 elements (string): • xoff - grid window's upper left corner x coordinate (0-indexed) • yoff - grid window's upper left corner y coordinate (0-indexed) • xsize - window's width size expressed in pixels • ysize - window's height size expressed in pixels selects a subwindow from the source image for copying based on pixel/line (column/row) location.
srsSubWindow	`array`: array of 4 elements (string): • ulx - window's upper left corner x coordinate • uly - window's upper left corner y coordinate • lrx - window's lower right corner x coordinate • lry - window's lower right corner y coordinate selects a subwindow from the source image for copying based on georeferenced coordinates expressed in the SRS of the input raster Note that the SRS window will be previously translated to grid coordinates.
options	`array`: array of elements expressed in the NAME=VALUE form, where: • NAME is the name of the creation option • VALUE is the selected value to be assigned to the option defines the creation options for the output file.

	Many formats/drivers have one or more creation options that can be used to control particulars about the output file created. For instance, the GeoTIFF driver supports creation options to control compression, and whether the file should be tiled. The creation options available vary by format driver, and some simple formats have no creation options at all. See Raster drivers format specific documentation for legal creation options for each format. For the full list of supported raster drivers see here

11.1 List all Mosaicsets

To list all Mosaicsets, after selecting a Workspace, the User must click the Mosaicsets button from the left menu. The system will display all Mosaicsets in the system, for the selected Workspace.

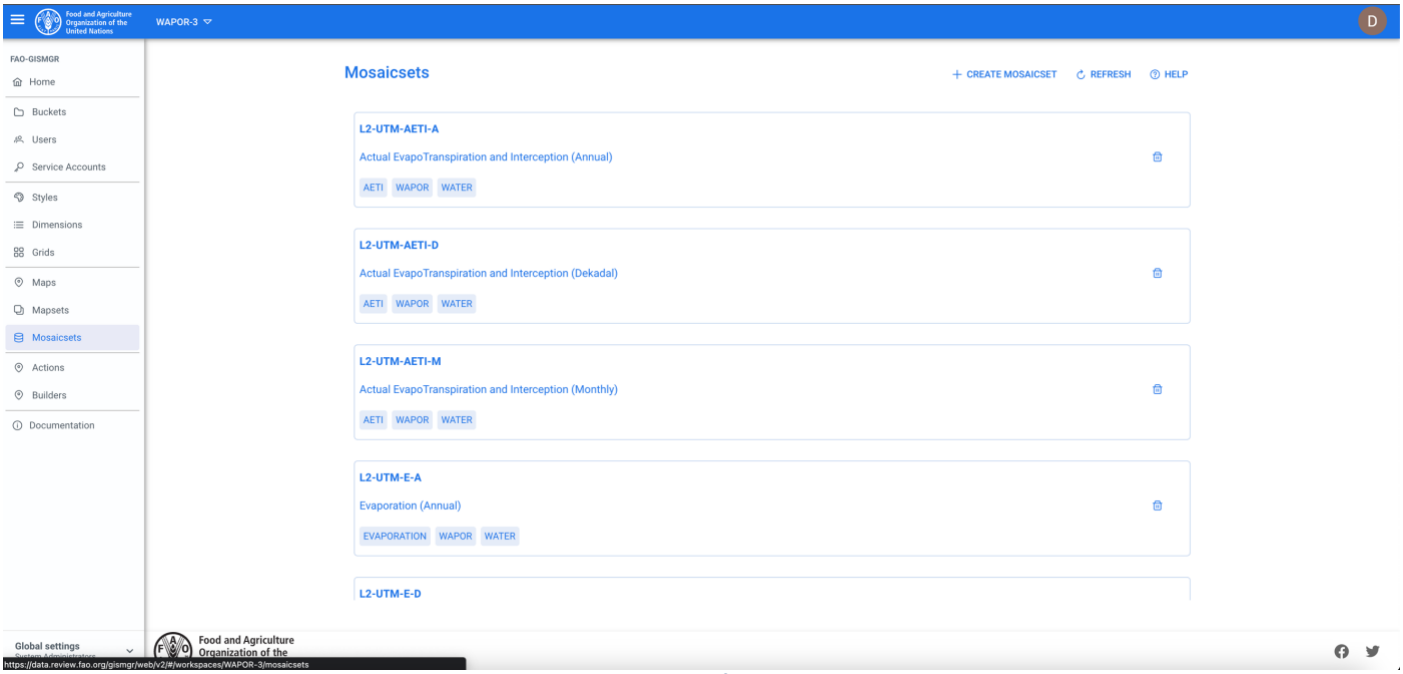

Figure 87 - List of Mosaicsets.

11.2 Create a Mosaicset

To create a new Mosaicset, after selecting a Workspace, the User must browse to the Mosaicsets page from the main menu. The system will display a list of the existing Mosaicsets. The User must press the Create Mosaicset button on the top right of the page, fill in the fields, the required ones being marked by an asterisk (*) and press the save button. If the operation is completed successfully, the system will display a confirmation message, otherwise it will display the error message.

Since a Mosaicset has many of fields to be defined, the interface has been divided in 3 tabs:

- **General info:** contains the main metadata, like code, caption, style, tags and the definition, through the dimensions, of the structure of the Mosaicset

- **Import info:** this part contains the information the system needs in order to process the data (raster files), applying optional translates, and relate them to the specific dimensions and styles
- **Rasters:** once the definition of the Mosaicset is completed and saved, it is possible to upload raster files. The list of raster files will appear in this tab, from which it is possible to view the metadata of a raster and eventually delete it.

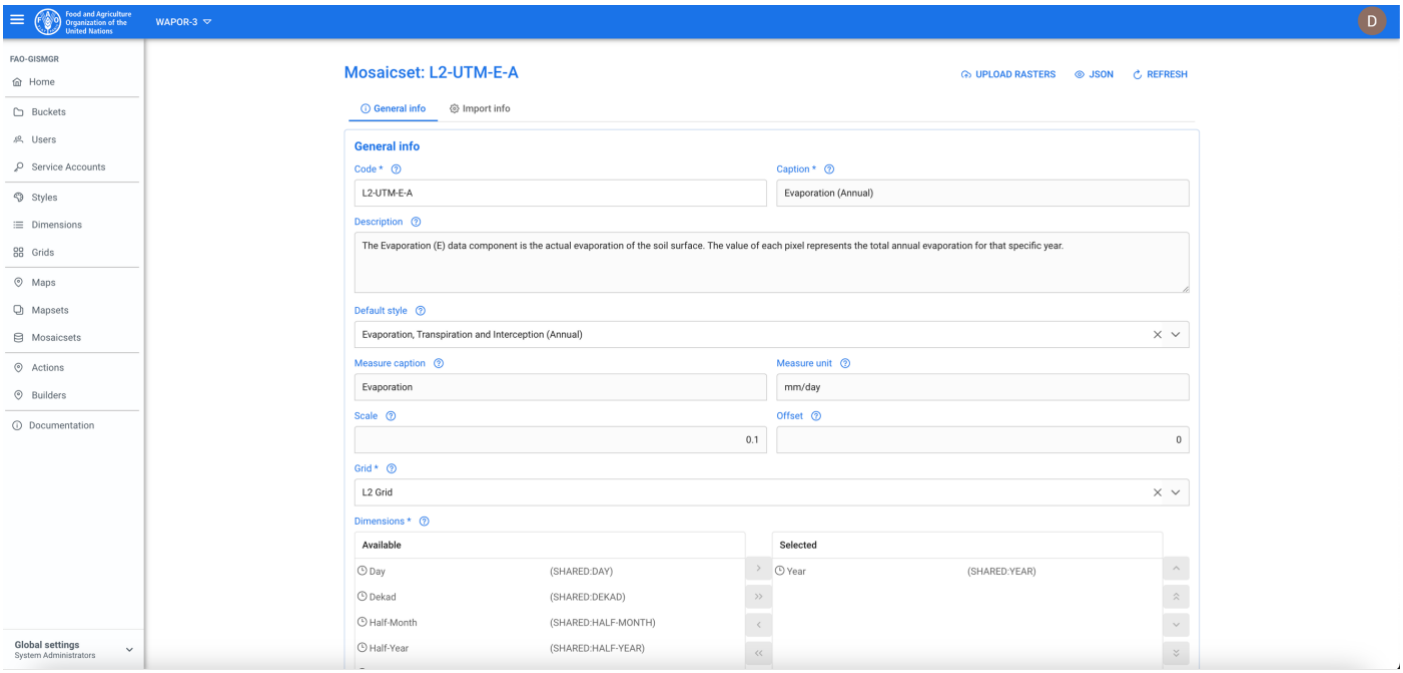

Figure 88 - Create a new Mosaicset.

11.2.1 Create a Mosaicset – General info

The General info of the Mosaicset allows to specify the code, caption and description of a Mosaicset, the first 2 being mandatory. The User can then define the default Style, the measure caption and unit, the scale and offset. After that, the User must select the Grid code, from a list of previously defined Grids, and the Dimensions. The system will display a list of available Dimensions from both the SHARED Workspace and from the current Workspace. By double clicking on a Dimension from the left list (Available), this Dimension will be selected and moved to the selected dimensions on the right (Selected). It is possible also to deselect a dimension (by double clicking on its name in the selected dimensions list or selecting it and then pressing the left arrow button in the panel) or to change the order of dimensions using the up/down arrows in the Dimension select box.

Note: *if a time dimension is present, it must always be the first in the list.*

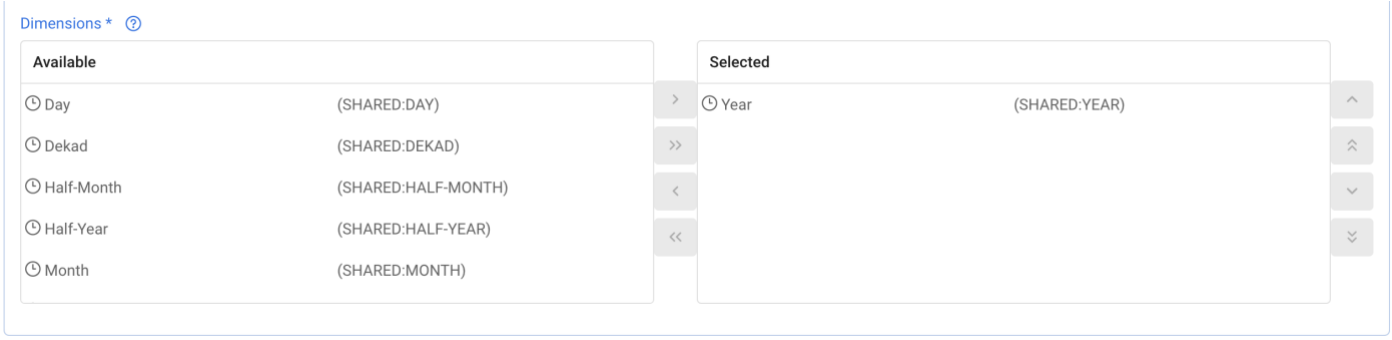

Figure 89 - Mosaicset, managing Dimensions.

11.2.2 Create a Mosaicset – Import info

Once the all the required information has been provided and validated in the General info tab, the User can proceed to the Import info tab to define how the system should import the data (raster files). This tab has 5 sections:

1. File info
2. Dimension members
3. Lookup
4. Style rules
5. Translate

11.2.2.1 File info

The User must enter the file extensions of the raster files that will be uploaded. The User must type the extension using the dot (.tif, .nc) and either press enter or tab or simply move to the following filed. The entered extension will appear highlighted in blue.

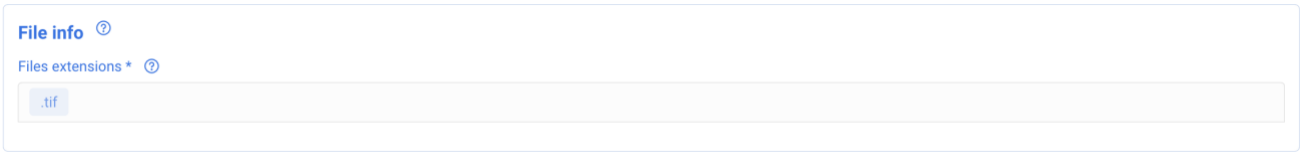

Figure 90 - Mosaicset, file extensions info.

11.2.2.2 Dimension members

This section instructs the system on how to deal with the files that will be imported and how they relate with the structure of the Mosaicset that has been defined in the previous tab (General info). For example, if a Mosaicset has a Grid, L2 UTM Zones, and one dimension, Year, the system will display an input form with 3 input fields: one for the regular expression, one for the Gird and one for the year Dimension. Below an example.

We have a list of files:
WAPOR-3.L2-UTM-E-A.26Q.2010.tif
WAPOR-3.L2-UTM-E-A.26Q.2011.tif
WAPOR-3.L2-UTM-E-A.26Q.2012.tif
WAPOR-3.L2-UTM-E-A.26Q.2013.tif
WAPOR-3.L2-UTM-E-A.33S.2010.tif

WAPOR-3.L2-UTM-E-A.33S.2011.tif
WAPOR-3.L2-UTM-E-A.33S.2012.tif
WAPOR-3.L2-UTM-E-A.33S.2013.tif

From very file, according to the Mosaicset definition, the system needs to extract the Grid code (the code of one of the possible values that the Grid Tiles may have, as if it was a Dimension) and the year (Year Dimension). The regular expression to extract this information would be:

Regular expression: *^WAPOR-3\.L2-UTM-E-A\.(\d{2}[A-Z])\.(\d{4})\.tif*
***Grid code** (L2-GRID):* *$1*
***Year dimension** (SHARED:YEAR):* *$2*

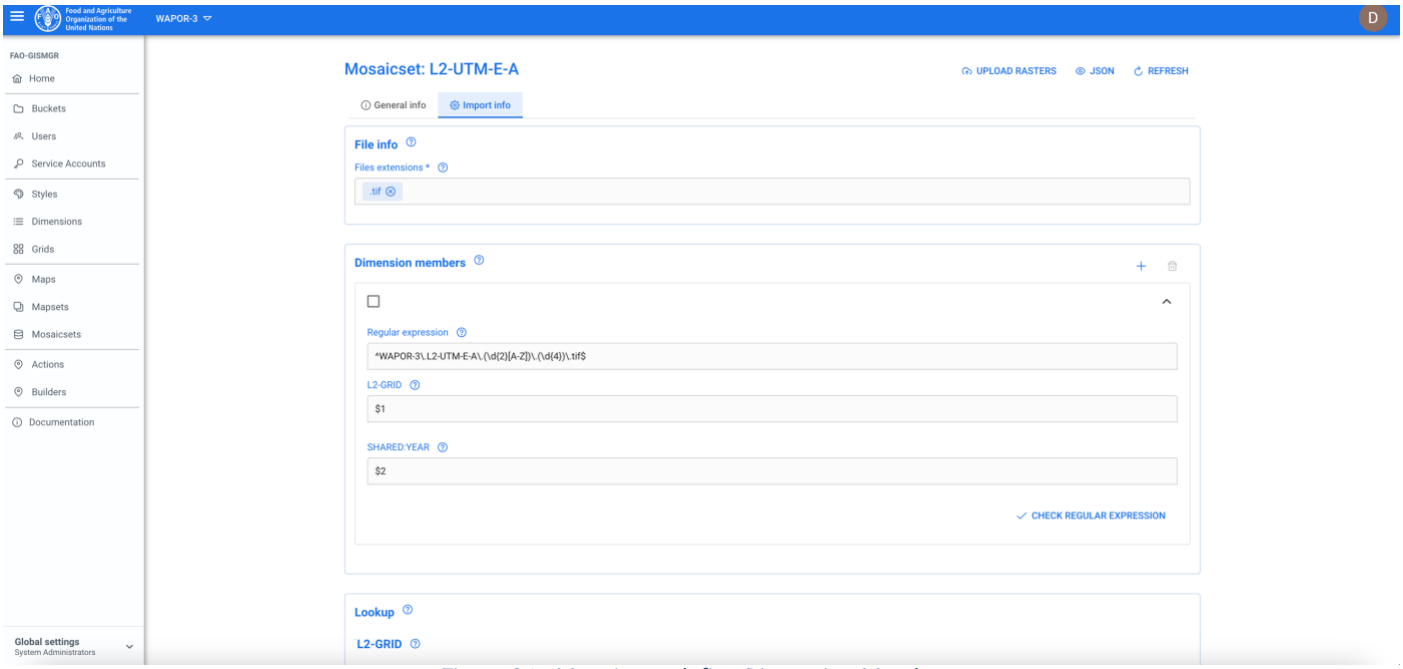

Figure 91 - Mosaicset, define Dimension Members.

The text between brackets *(\d{2}[A-Z])*and *(\d{4})* are the “groups” of information we want to catch, so here we have 2 group, *$1* and *$2*. Group *$1* will capture the grid code, while group *$2* the year.

Below an example (https://regex101.com/r/5QHlJX/1).

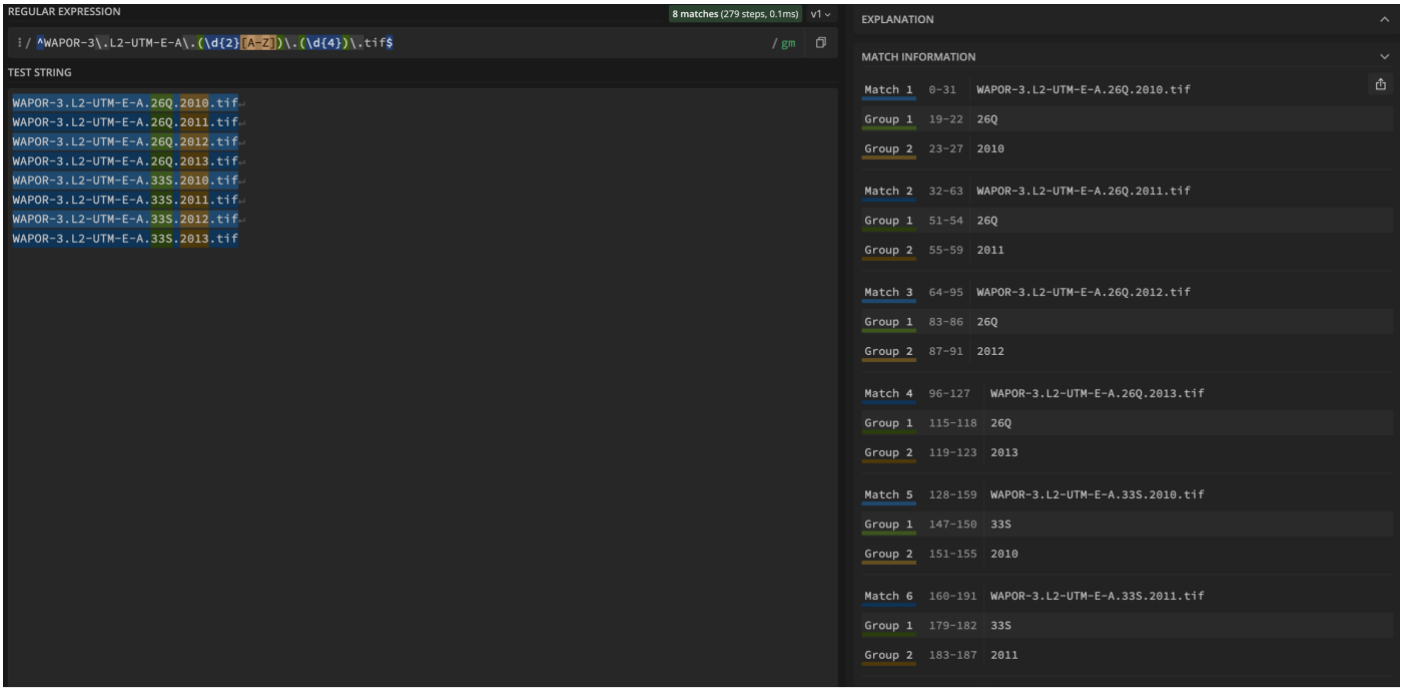

Figure 92 - Mosaicset, regular expression example.

To validate the Regular expression in the system, the User must press the Check regular expression button and insert the name of a raster file. The User must then press the validate button. The system will show how the values extracted from the file name map to the dimensions.

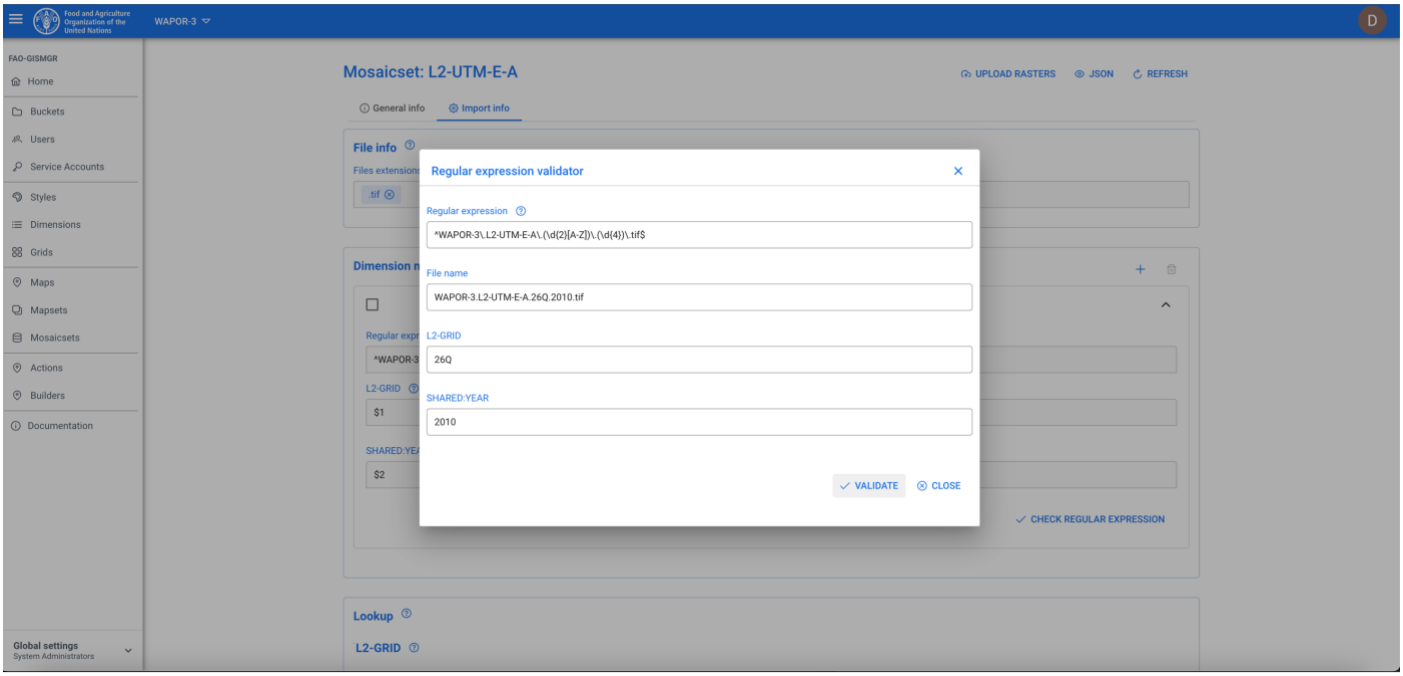

Figure 93 - Mosaicset, validate a regular expression.

It is possible, if necessary, to define more than one rule (pressing the + button on the dimension member box) if one does not capture all possible values of the files to be uploaded.

Note: *the order of the dimension members rule is important: if the first rule is looser and captures all the possible values of a file name, the rules following will never be evaluated.*

11.2.2.3 Lookup

In the Lookup box, the system will display the grid and the dimensions that have been selected for the Mosaicset by displaying their code (workspaceCode:dimensionCode). To enter a Lookup, the User must press the + button on the right side of the desired dimension. The system will open a popup where to enter as **key** the value extracted by the regular expression for that dimension, as value the corresponding actual value among the dimension members of the dimension.

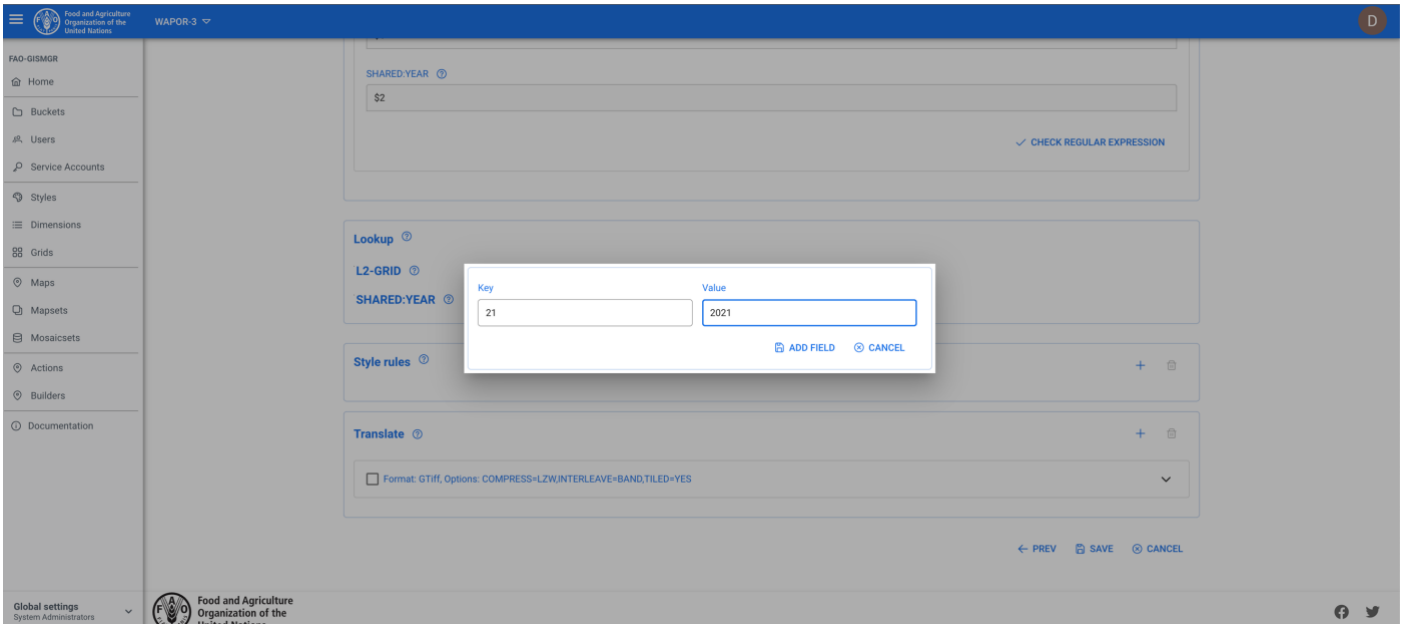

Figure 94 - Mosaicset, adding a Lookup.

11.2.2.4 Style rules

It is possible to assign a specific Style to a specific raster. To specify a style rule, the User must press the + button on the top right of the Style rule box. The system, similarly to the lookup box, will display the dimensions that have been selected for the Mosaicset by displaying their code (workspaceCode:dimensionCode). For the desired dimension/s (the others can be left null), the User must add the list of values (pressing tab or enter) of the raster and then select the style for those values from the dropdown list below. It is possible to define zero or more lookups for every Mosaicset.

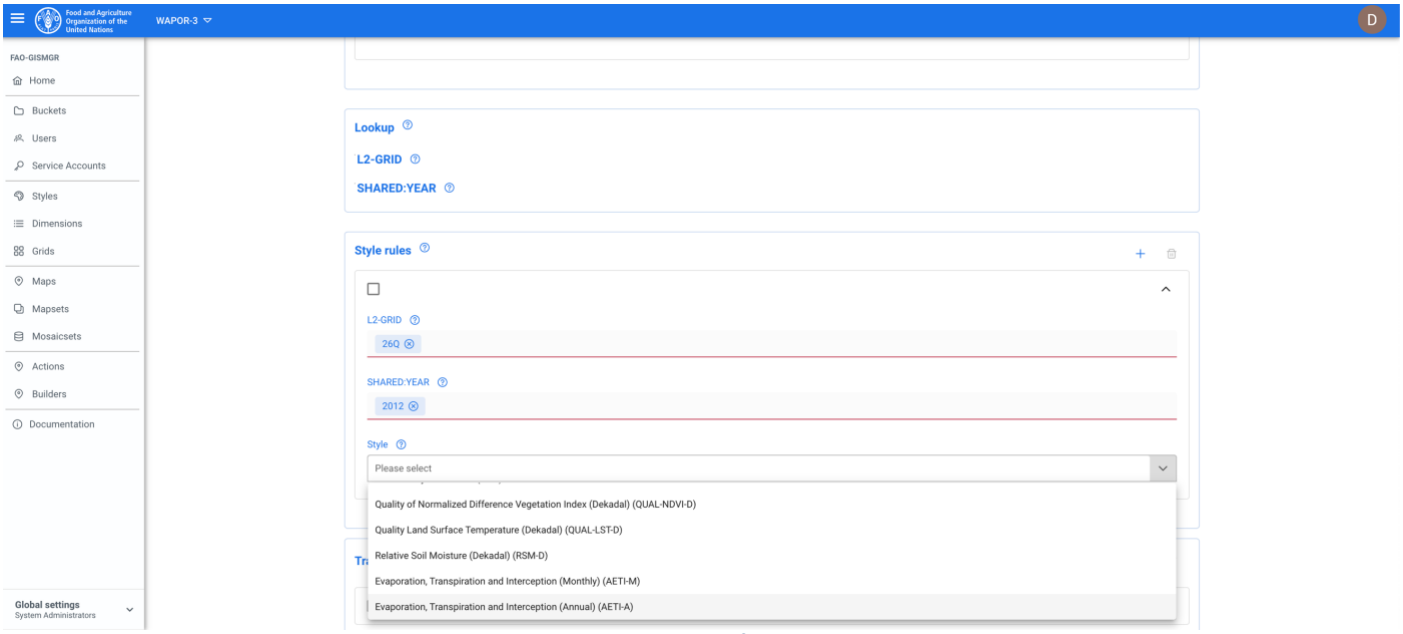

Figure 95 - Mosaicset, defining a Style Rule.

11.2.2.5 Translate

The Translate/s is optional. If no translate is inserted, the system will automatically add a translate that transforms the uploaded file into a COG (-of GTiff INTERLEAVE=BAND -co TILED=YES -co COMPRESS=LZW).

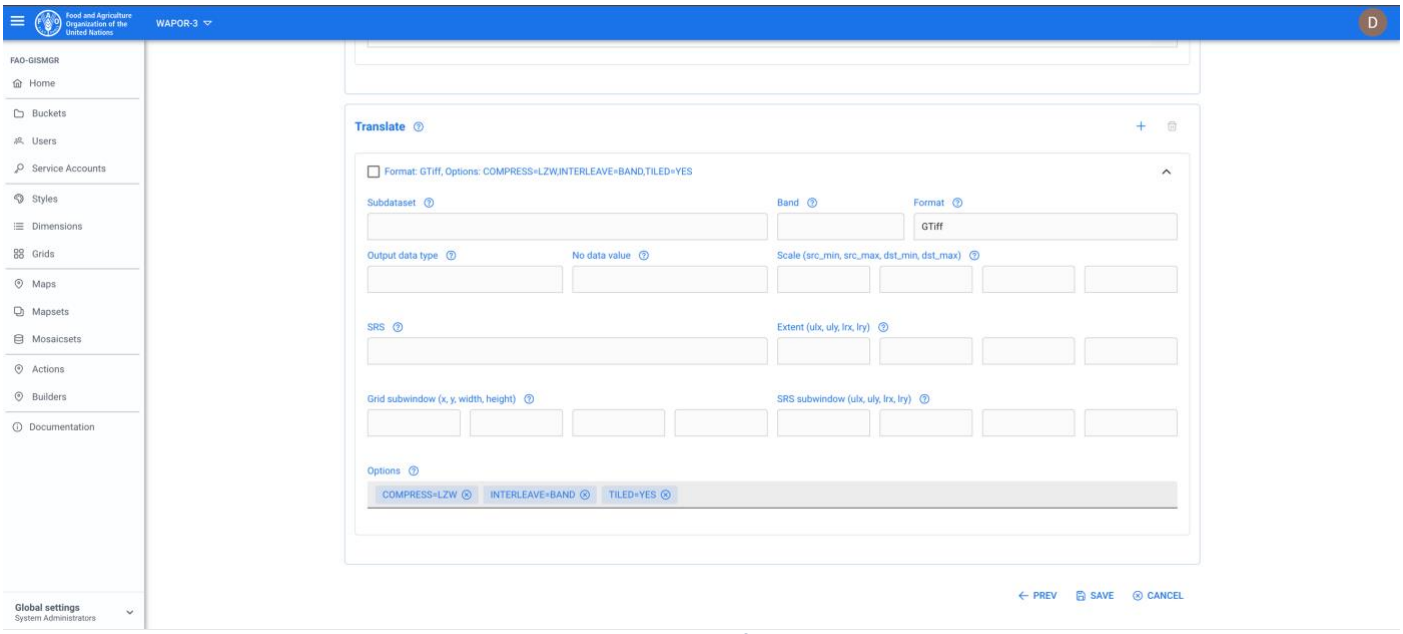

Figure 96 - Mosaicset, defining a Translate.

11.2.3 Create a Mosaicset – Rasters

Once a Mosaicset is saved, it is possible to upload the raster files. The list of raster files will be visible in the Rasters tab, from where the User can see, the metadata (geospatial info) of a raster file and eventually delete a raster file.

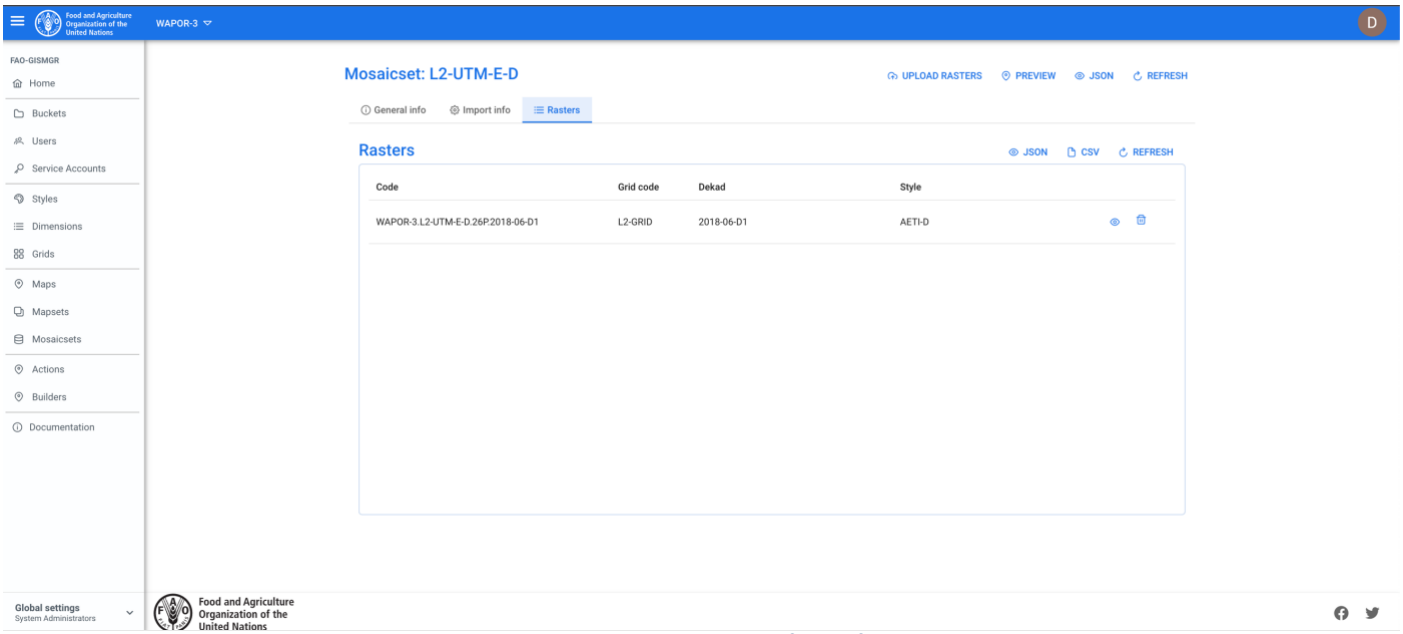

Figure 97 - Mosaicset, list of rater files.

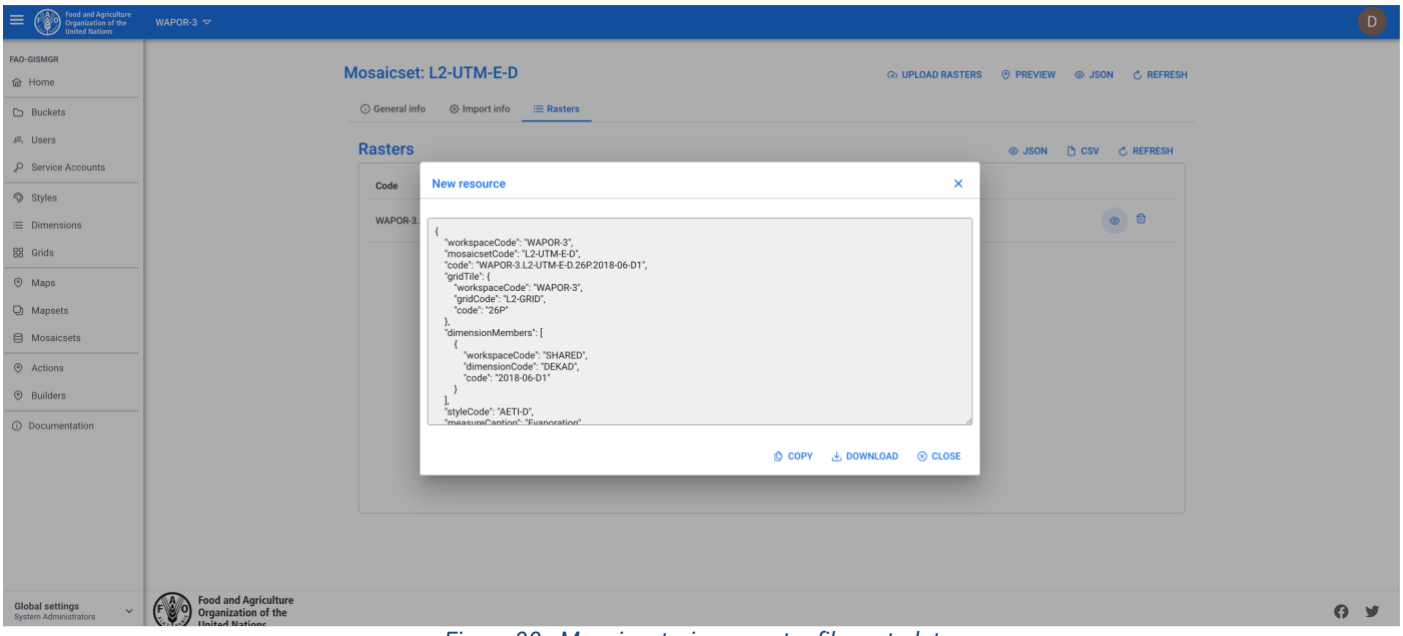

Figure 98 - Mosaicset, view a raster file metadata.

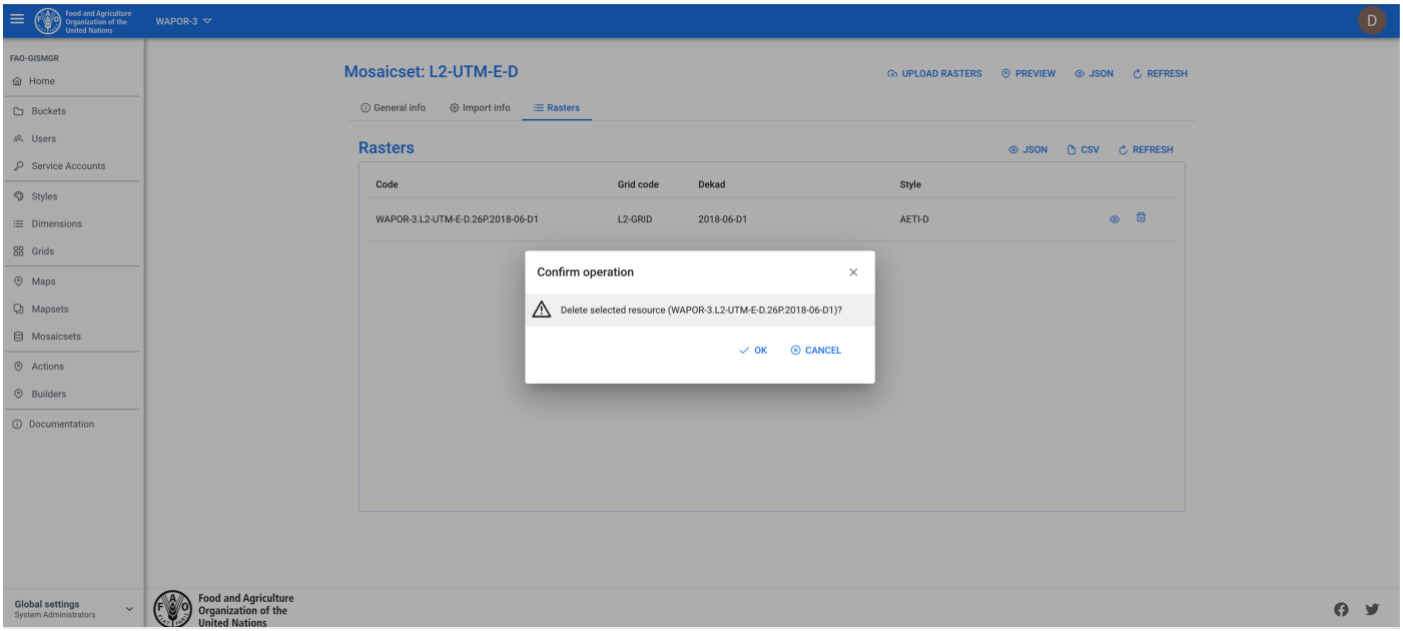

Figure 99 - Mosaicset, delete a raster file.

11.3 Update a Mosaicset

To update a Mosaicset, the User must select an existing Mosaicset from the list of Mosaicsets by clicking/tapping on the desired one. The system will display the selected Mosaicset input form to update the data. Once completed, the User must press the save button to save the changes. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message. The fields of the Mosaicset can be updated according to the following table:

Field name	Updatable
General info - Code	No
General info - Caption	Yes
General info - Description	Yes
General info - Default style code	Yes
General info - Measure caption	Yes
General info - Measure unit	Yes
General info - Scale	Only if no rasters have been uploaded
General info - Offset	Only if no rasters have been uploaded
General info - Dimensions	No
General info - Flags	Yes
General info - Tags	Yes
General info - Additional info	Yes
Import info – File extensions	Only if no rasters have been uploaded
Import info – Dimension members	Only if no rasters have been uploaded
Import info – Lookup	Only if no rasters have been uploaded
Import info – Style rules	Only if no rasters have been uploaded
Import info –Translate	Only if no rasters have been uploaded

11.4 Upload a raster file/s

Once the metadata for the Mosaicset has been created/updated, the User can upload, to the upload bucket, the file/files that constitute the Mosaicset. The User must browse to the Upload bucket or click the Upload button on the top right of the Mosaicset detail window. The bucket page will open in the browser. The User must drag the file/s onto the bucket and the upload will start. Once the file is uploaded, the system will process the file/s to publish the Mosaicset.

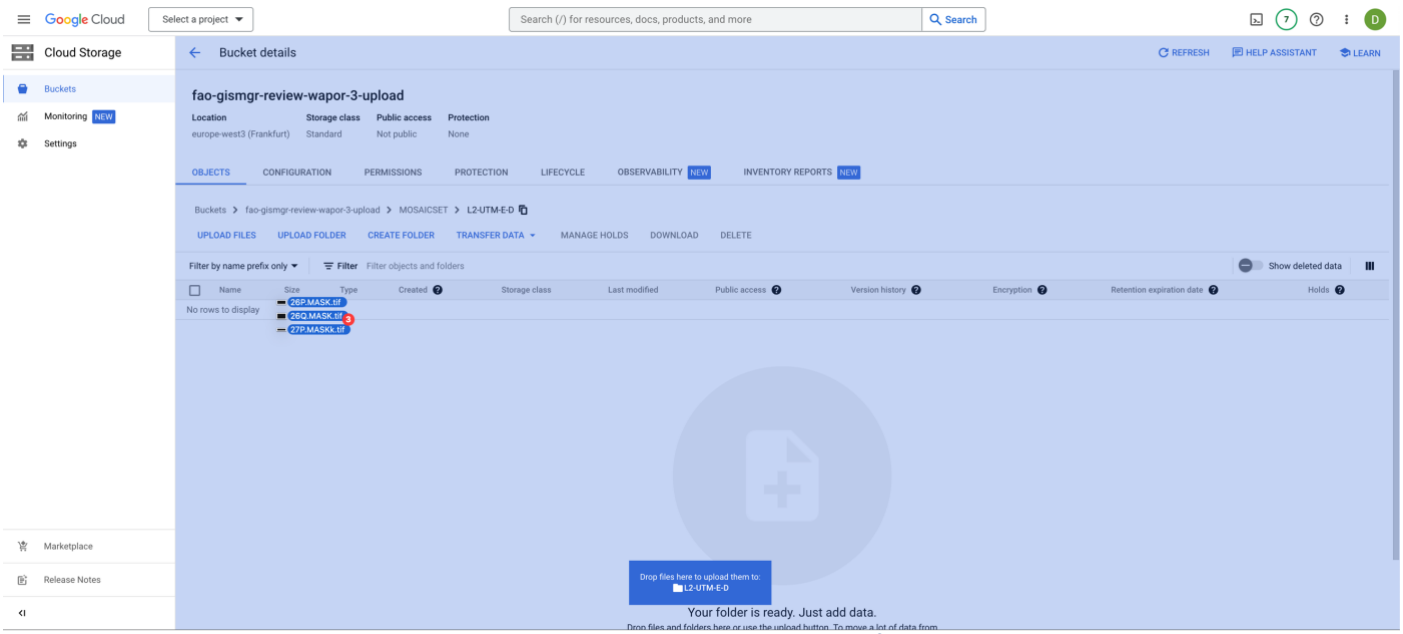

Figure 100 - Mosaicset, upload raster files.

11.5 Preview a Mosaicset

When the selected Workspace data bucket is PUBLIC, when a Mosaicset is created and the relative raster/s file/s have been uploaded to the Upload bucket and processed successfully, the system will display a Preview button. The User must press the button to be redirected to a page with the Mosaicset preview. From this page it is possible to select the different raster/s available (selecting different values for the available dimensions), view the metadata and the legend.

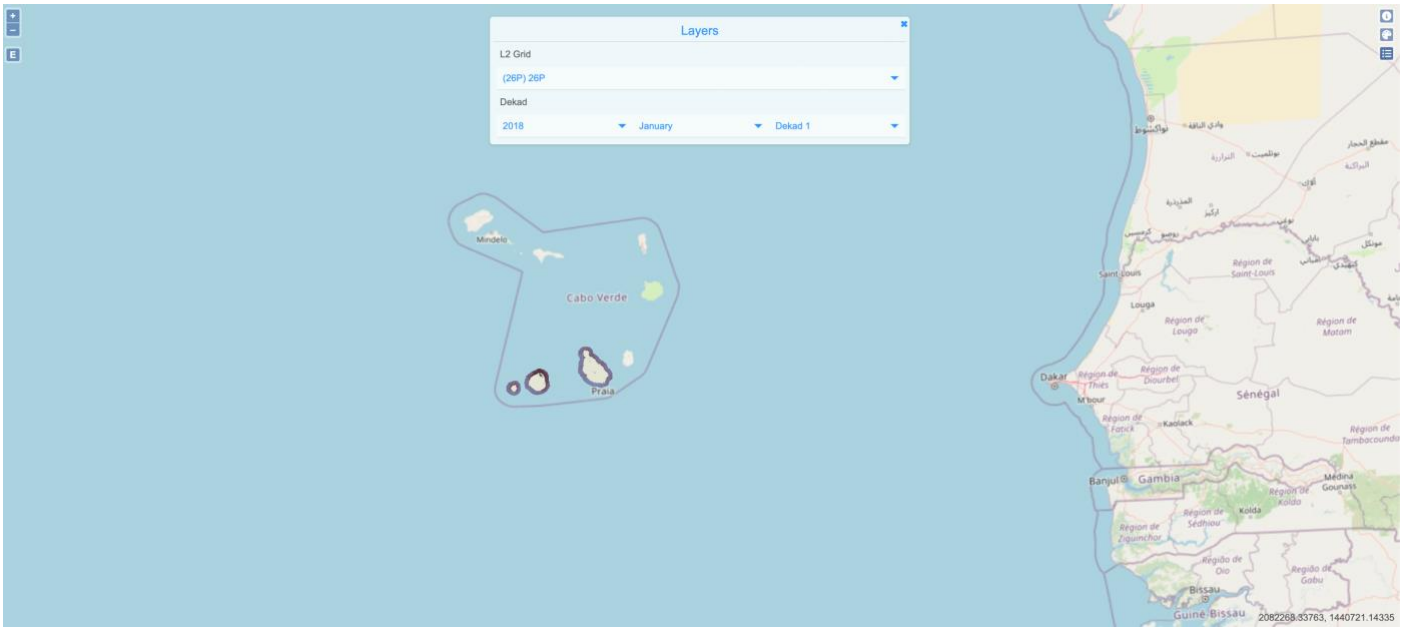

Figure 101 - Mosaicset preview.

11.6 Delete a Mosaicset

The User must press the Mosaicset button from the left menu, after selecting a Workspace. The system will display the list of all Mosaicsets for the selected Workspace. To delete a Mosaicset, the User must press the corresponding delete button. The system will display the deletion confirmation popup message. The User must choose ok to confirm deletion or cancel to cancel the operation. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

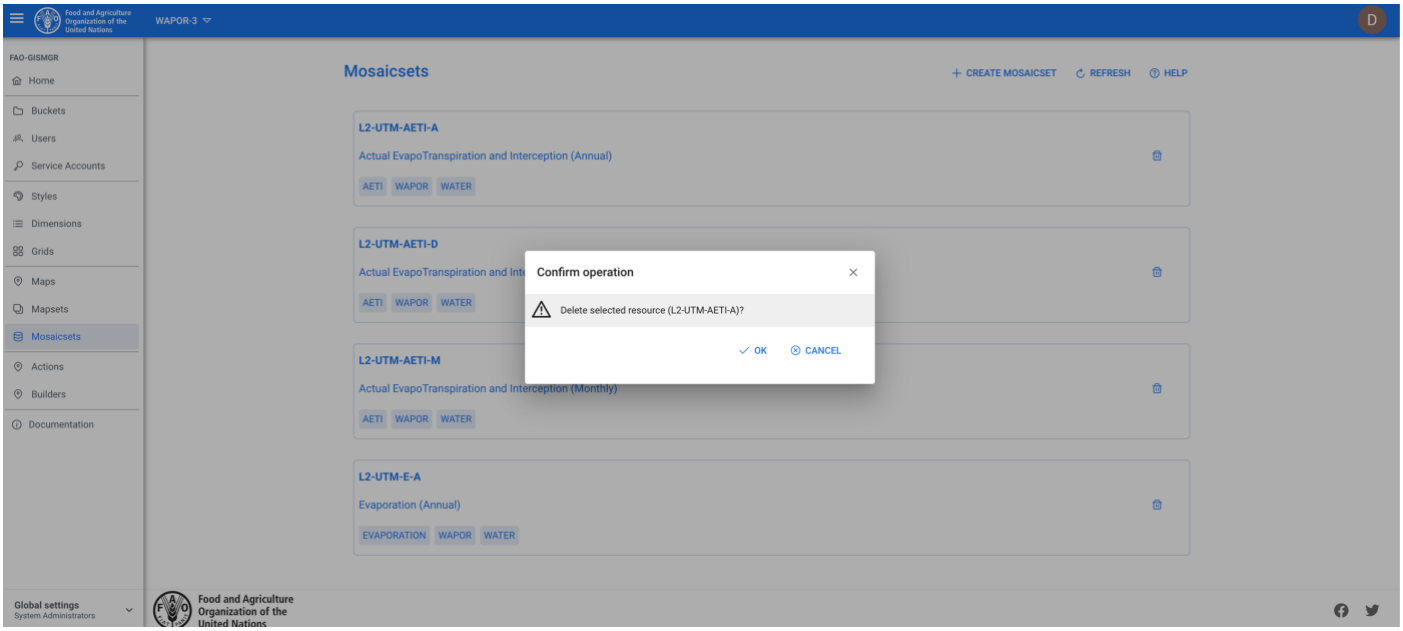

Figure 102 - Delete a Mosaicset.

12 Storage Users

Storage Users can access the DATA bucket of all workspaces present in the system. Similarly to system Users, GISMGR manages resource access permissions using the concept of Users and Roles. A User is identified by a valid and existing email address. A Role specifies which operations that user can perform on resources belonging to a specific workspace.

FIELD	DESCRIPTION
`email`	`string` : the email address that identifies the user. cannot be null; must be a valid and existing email address.
`role`	`string` : the role assigned to the user within the selected workspace cannot be null; allowed values are: • VIEWER • EDITOR

12.1 Storage User roles

ROLE	DESCRIPTION
`EDITOR`	• can read and edit bucket metadata, including IAM policies. • can create, list, view, download, replace, edit and delete objects • can read object metadata when listing (excluding IAM policies); • can create, delete, and list tag bindings
`VIEWER`	• can list a bucket's contents and read bucket metadata, excluding IAM policies. • can read/download objects and their metadata, excluding ACLs. • can read object metadata when listing objects (excluding IAM policies).

12.2 List all Storage Users

To list all storage users, the User must select Global Setting from the bottom left menu and then select Storage Users. The system will display all the Storage users present in the system and their role.

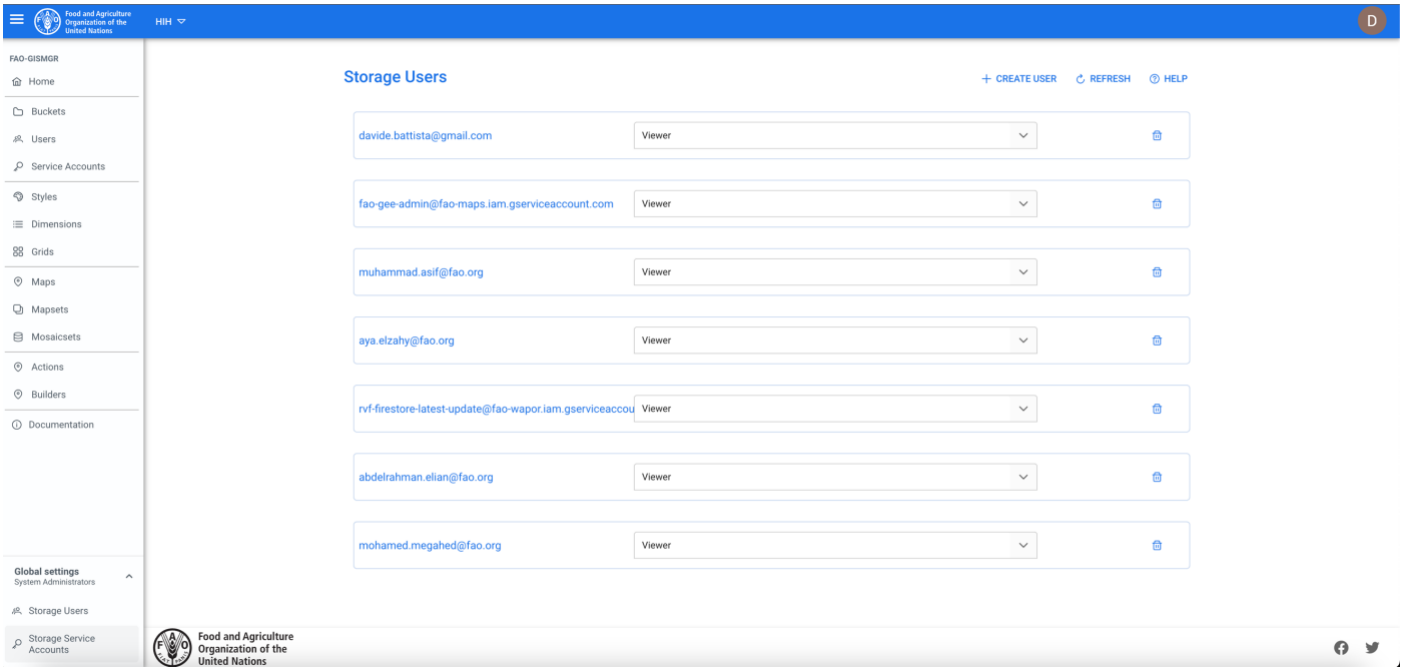

Figure 103 - Listing Storage Users

12.3 Create a Storage User

To create a new Storage User, the User must browse to the Global Settings from the bottom left menu and then select Storage Users. The system will display a list of the existing Storage Users. To create a new Storage User, the User must press the Create User button on the top right of the page. The system will display a popup: the User must enter the email and the Role for the new Storage User being created and press the save button. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

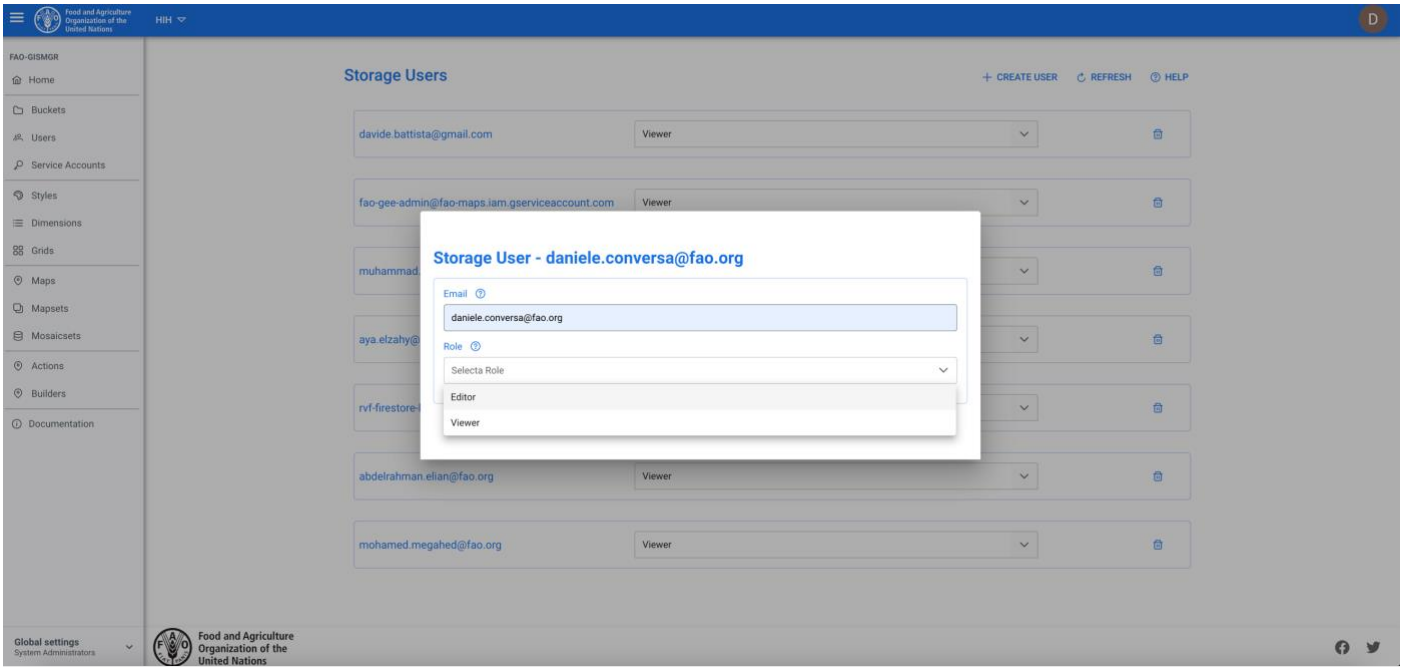

Figure 104 - Create a Storage User

12.4 Update a Storage User

The User must browse to the Global Settings from the bottom left menu and then select Storage Users. In the list, the User must select the desired Role from the dropdown present at the side of every Storage User in the list. After changing the Role, the system will update the Storage User with the new role. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

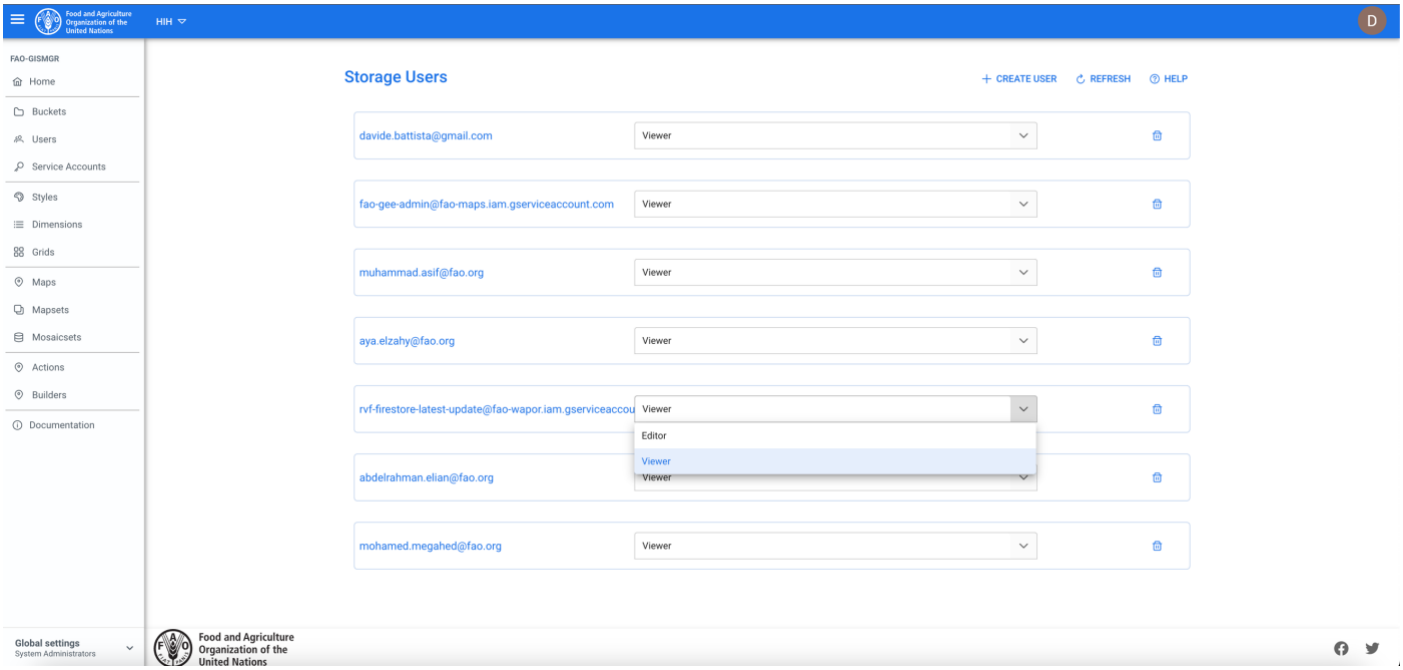

Figure 105 - Update a storage user

12.5 Delete a Storage User

To delete a Storage User, the User must browse to the Global Settings from the bottom left menu to select Storage Users. The User must then press the delete button of the Storage User to be deleted. The system will display the deletion confirmation popup message. The User must choose ok to confirm deletion or cancel to cancel the operation. If the operation is completed successfully the system will display a confirmation message, otherwise it will display the error message.

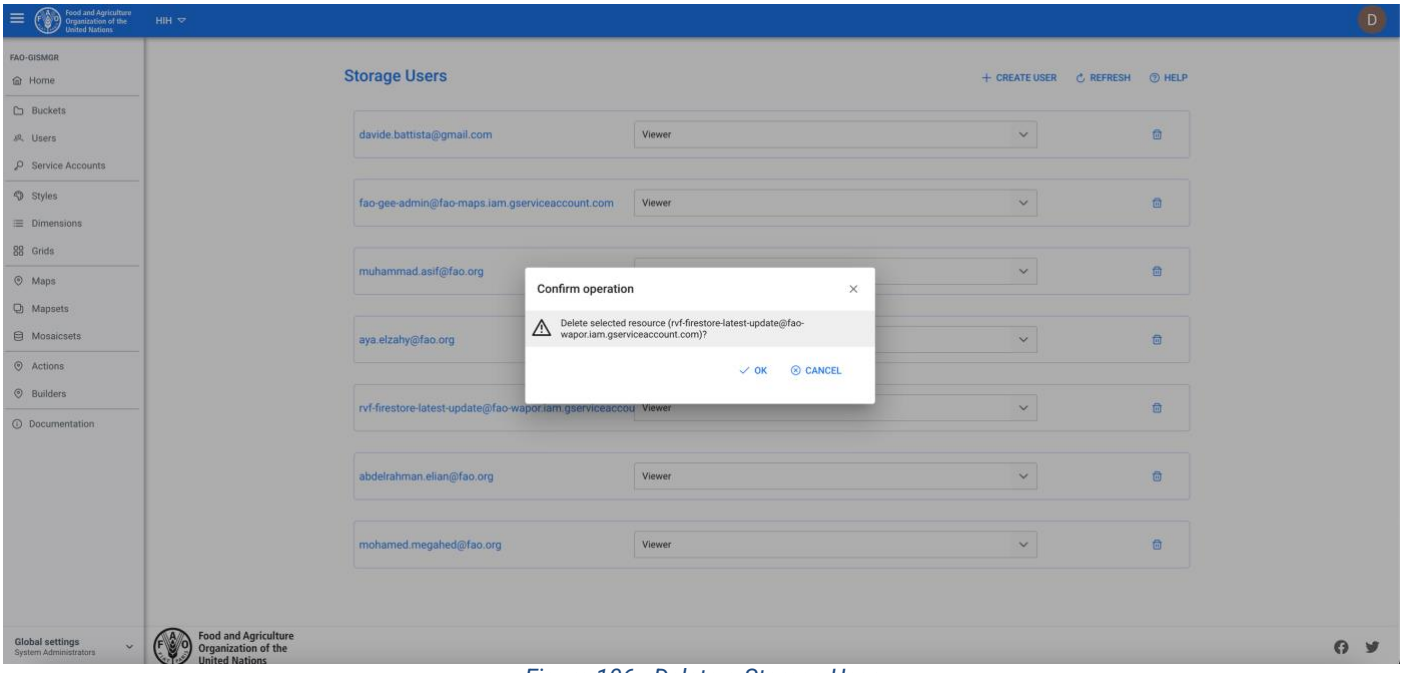

Figure 106 - Delete a Storage User

13 User profile

The User profile page displays the personal information of the User logged into the Application, his roles within the system and, eventually, the API Key to be able to access FAO GISMGR 2.0. API.

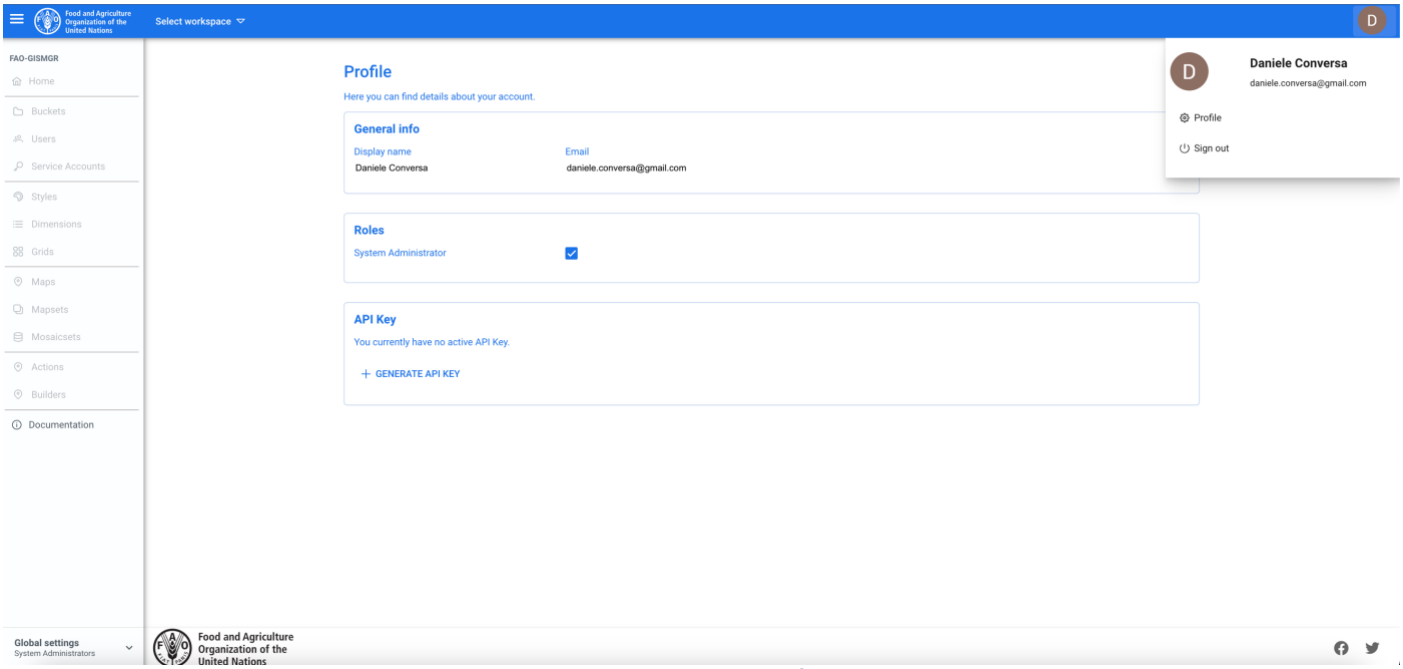

Figure 107 - User profile

13.1 API Key

Some requests the application sends to the FAO GISMGR API must include an authorization token (**ID token**). The token identifies a User account. The user account must be previously granted with permissions by the workspace's administrators. In order to retrieve an ID token programmatically, the User must generate the user account's API Key.

To generate the API Key, the User must browse to the Profile page selecting Profile from the Avatar menu at the top right of the Web application window. The User must press the Generate API Key button. The system will generate the user account API Key (80 alphanumeric characters string). This will be shown only once (at this time), so it must be copied and stored in a safe place and, above all, should not be shared with anyone.

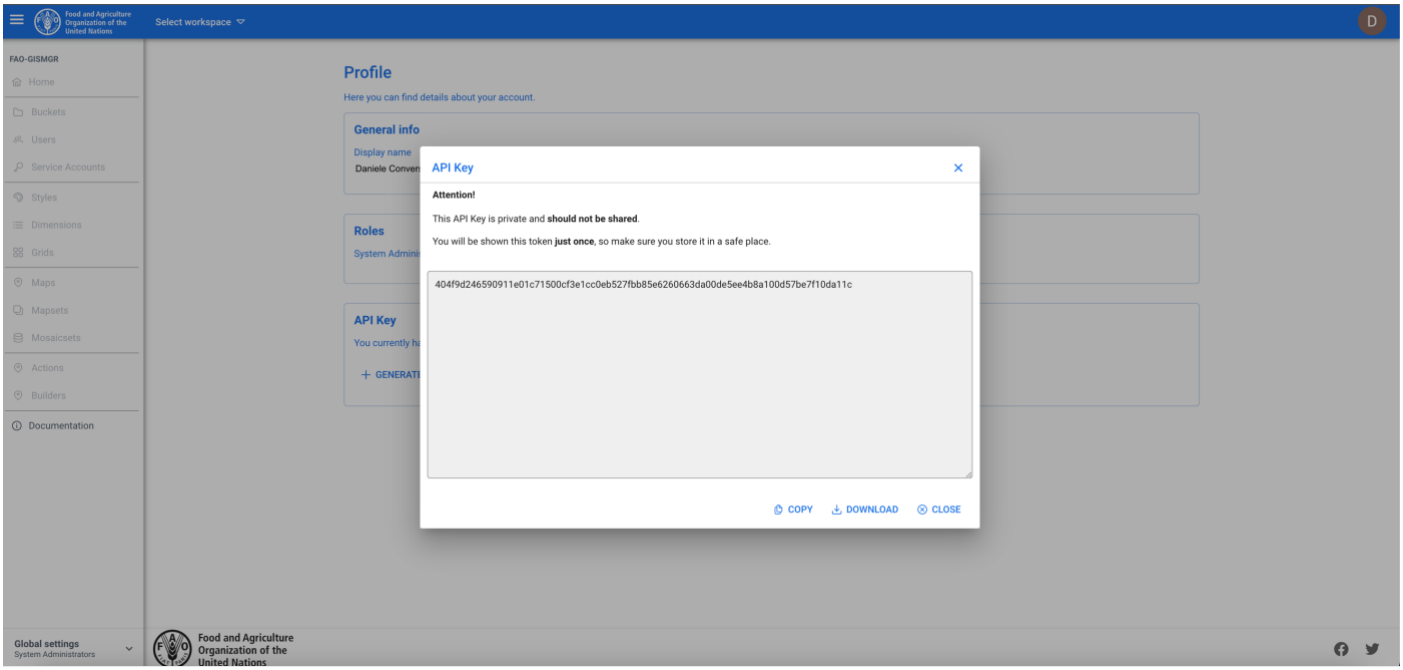

Figure 108 - Generating a User API key

After an API Key has been generated, it can be temporarily disabled, re-enabled or be definitively deleted (the User will be able to generate a new API key).

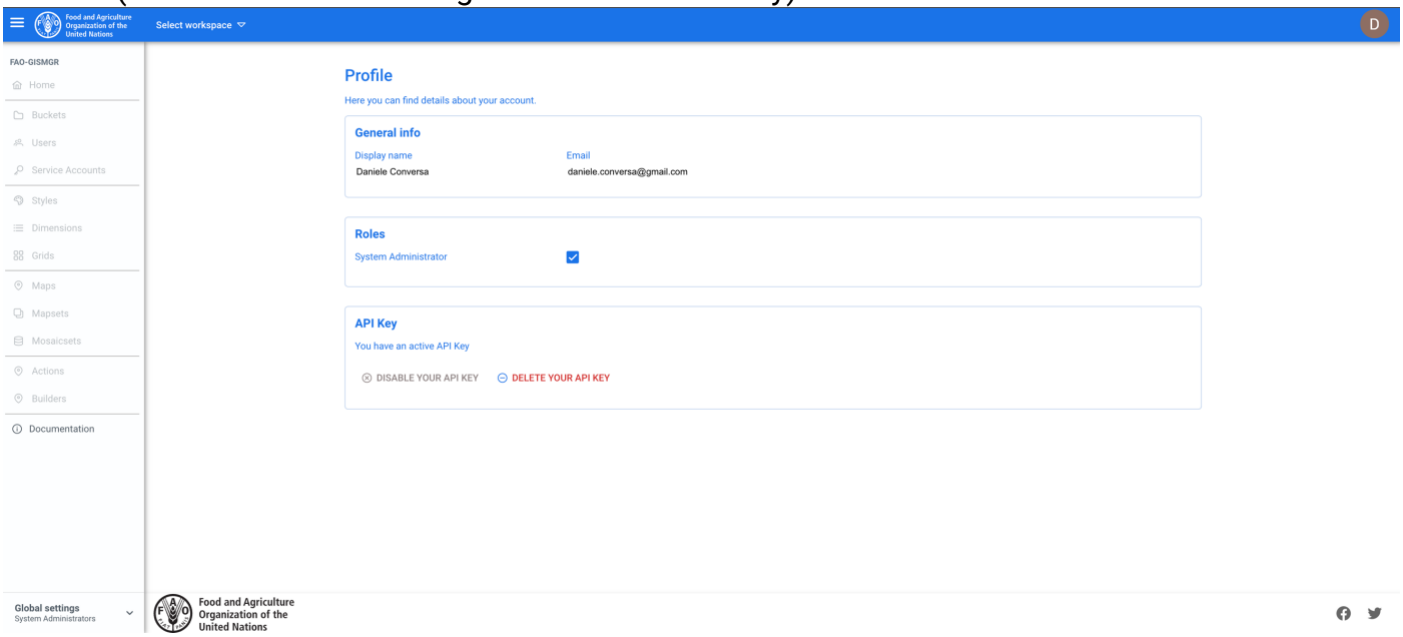

Figure 109 - Disabling or deleting User API Key

All maps in this publication have been created using shapefiles from the United Nations.
Source: FAO Hand-in-Hand Geospatial Platform. 2023. Map geodata [shapefiles]. New York, USA, United Nations.
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