



Land Use Planning for Land Degradation Neutrality

USER GUIDE

A step-by-step guide to running a participatory land use planning project for Land Degradation Neutrality with LUP4LDN.

Field	Detail
Audience	Land use planners, national and sub-national institutions, land users, policy makers, research agencies
Applies to	LUP4LDN v1.1 — Community version at https://app.landusetool.org
Maintained by	SCiO P.C., Agia Paraskevi, Greece — winner of the GEO-LDN International Technology Innovation Competition (2021)
Software licence	GNU General Public License v3.0 — https://github.com/SCiO-systems/lup4ldn
This document	Creative Commons Attribution 4.0 International (CC BY 4.0) — you may copy, adapt and translate it, with attribution
Guide version	2.0
Date	August 2026
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AT A GLANCE

- 01 Prepare your data.** Region of interest, land use map, land degradation map, suitability maps, focus areas — GeoTIFF for rasters, GeoJSON for polygons. Or start with the tool's global defaults.

- 02 Set the context.** Sign up, create a project, invite your team, pin the region of interest and choose your maps.
- 03 Read the current state.** Look at land use against suitability, then at the anticipated new degradation, and pick your hotspots.
- 04 Evaluate current land management.** Define focus areas, agree the assessment indicators and score the practices in place.
- 05 Plan the transitions.** Set the LU transition impact matrix, build consecutive scenarios, and choose SLM alternatives from WOCAT as a team.
- 06 Consolidate.** Open the neutrality matrix and map, read the balance, and calibrate until the plan works.

How to use this guide

Sections 1–3 are background and preparation — read them once. Sections 4–10 are the operational walkthrough and follow the order you will actually work in. Section 11 lists what you can take out of the tool, Section 12 collects the things that most commonly go wrong. Sections 13–15 cover privacy, support and where the tool is going. Section 16 defines the acronyms, and the annexes hold the dataset metadata, the standards conformance statement, the version history and the translation instructions.

TIP

Most of the effort in a real LUP4LDN project is spent **before** you log in — finding, cleaning and reformatting national data. Read Section 3 early and start collecting data in parallel with your first workshop.

1. About LUP4LDN

LUP4LDN integrates Land Degradation Neutrality (LDN) into a participatory land use planning (LUP) process. It lets a group of stakeholders evaluate land use (LU) and land management (LM) transition scenarios in a transparent, well-informed way, and reports the results quantitatively against SDG indicator 15.3.1 and its three sub-indicators.

The tool was developed by SCiO with ICARDA, the University of Sassari, WOCAT and the ELD Initiative after winning the GEO-LDN International Technology Innovation Competition in 2021, and was co-developed and piloted with national stakeholders in Tunisia and Burkina Faso. SCiO has maintained and operationally supported it since.

1.1 The three questions it answers

- **Where** is it most crucial to focus efforts to avoid, reduce or reverse land degradation?
- **What** SLM interventions are optimal and feasible in that context to achieve neutrality?
- **How** do gains and losses balance out — shown as maps, tables and radar diagrams.

1.2 What LUP4LDN is not

LUP4LDN is **not a web-GIS**. It lets you upload the data it needs and download every intermediate and final map as a GIS file, but data preparation and any further spatial analysis (overlays, statistics) are done outside the tool, in desktop GIS software such as QGIS.

It is also **not a predictive model**. Anticipated future degradation is not simulated: it is derived from **your** evaluation of how sustainable current land use and land management are, on the assumption that unsustainable use will cause or worsen degradation.

1.3 The assumptions this tool makes

Every model rests on assumptions. LUP4LDN's are deliberately few and deliberately visible, so that you can defend — or challenge — any number the tool produces.

Assumption	What it means for your results
Unsuitable use leads to degradation	Anticipated new degradation is computed as an overlay: where a land use is practised on land that is not suitable for it, that land is expected to degrade during the planning period. It is not a process model, and no rate of degradation is simulated.
Expert judgement carries the land management assessment	Indicator scores from -3 to +3 are supplied by the participants, not measured by the tool. The tool asks you to score indicators; it deliberately does not prescribe how to measure them.
Contextual similarity transfers SLM knowledge	SLM options are short-listed from WOCAT on the basis that a technology documented in a comparable socio-ecological context is a plausible candidate in yours. It is a plausibility filter, not evidence of local effectiveness.
Scenarios are consecutive, not alternative	Each scenario builds on the one before it, running from the current baseline year to the 2030 horizon of SDG target 15.3. Editing a scenario mid-chain invalidates the ones after it.

Assumption	What it means for your results
Neutrality is assessed like for like	Gains and losses are balanced within comparable land types, following the UNCCD LDN conceptual framework.
Output quality follows input quality	The global defaults are 5 arc-minute in places. They support national comparison and a first look; they are generally too coarse for local decision-making, and the tool does not warn you at the point of use.

NOTE

Because the assessment is expert-driven, LUP4LDN is designed to be used **in a workshop**, not alone at a desk. The pilots ran an introductory workshop plus a two-to-four-day hands-on workshop.

1.4 Two levels of planning

Everything in the tool happens at one of two spatial levels, and it is worth fixing the distinction in your mind before you start.

Level	What it is	What you plan there
Region of Interest (RoI)	The whole study region — an administrative unit (GADM level 1 or 2) or a biophysical area such as a watershed.	Land use transitions: converting land from one LU type to another, for example cropland to forest by afforestation.
Focus Area (FA)	One or more smaller polygons inside the RoI — typically degradation hotspots your team knows well.	Land management transitions: changing practices within the same land use type, for example adopting soil and water conservation measures.

1.5 Licence, source code and how to cite

LUP4LDN is free and open-source software. The application is published under the **GNU General Public License v3.0**, which means you may run it, study it, modify it and redistribute it, provided that derivative works are distributed under the same licence and preserve the attribution and licence notices.

What	Where
Umbrella repository	https://github.com/SCiO-systems/lup4ldn — overview, architecture, release history, licence
Backend API	https://github.com/SCiO-systems/landusetool-backend — Laravel (PHP)
Frontend dashboard	https://github.com/SCiO-systems/landusetool-frontend — React (Diamond-React)
Software licence	GNU General Public License v3.0 — see LICENSE in each repository
This guide	Creative Commons Attribution 4.0 International (CC BY 4.0)
Hosted Community version	https://app.landusetool.org — free, open registration
Self-hosting	Start the backend first (it exposes the API the frontend consumes), then the frontend with REACT_APP_API_BASE_URL pointed at it. See the README in each repository.

How to cite LUP4LDN

Zucca, C., Le, Q.B., Karampiperis, P., Lemann, T., Thomas, R., Thiombiano, B.A., Hermassi, T., Bonaiuti, E. & Zervas, P. (2024). Toward an operational tool to integrate land degradation neutrality into land use planning: LUP4LDN. *Land Degradation & Development*, 35(7), 2489–2507. <https://doi.org/10.1002/ldr.5075>

LICENCE

When you publish maps, tables or figures produced with LUP4LDN, please cite the paper above and name the tool and its version — for example, “produced with LUP4LDN v1.1 (SCiO, GPL-3.0)”. This is what lets other planners trace and reproduce your analysis.

1.6 How the tool is put together

You do not need this to use LUP4LDN, but it helps when you are deciding whether to self-host, when you are explaining the tool to an IT department, or when you want to know exactly where your data goes. Figure 1 is a logical view: the component boundaries follow the two application repositories, and the platform services follow the LUP4LDN privacy policy.

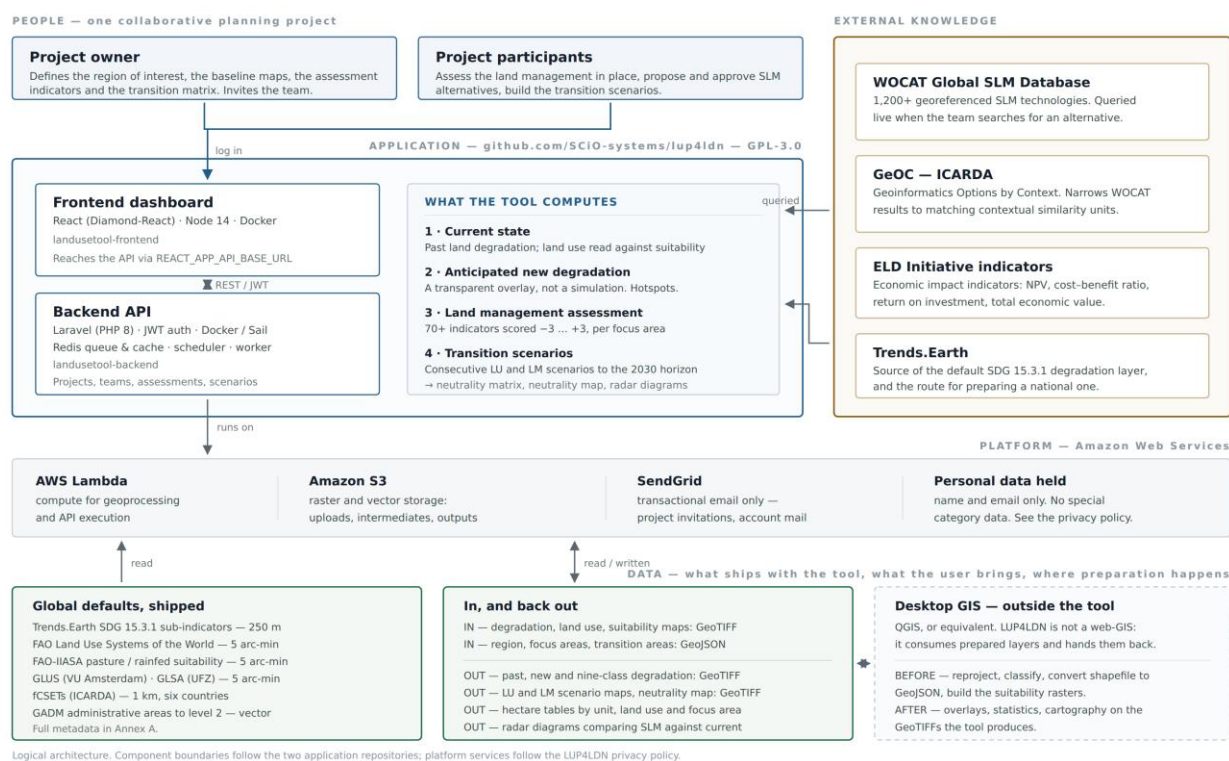


Figure 1 — LUP4LDN logical architecture: who uses it, what runs where, which external knowledge bases it queries, and what data goes in and comes out.

- **Frontend dashboard** — a React single-page application. It holds no analysis logic of its own; everything it shows comes from the API.
- **Backend API** — Laravel (PHP 8), with JWT authentication, a Redis queue and cache, a scheduler and a worker. It owns projects, teams, assessments and scenarios, and orchestrates the geoprocessing.
- **Platform** — AWS Lambda for compute, Amazon S3 for raster and vector storage, SendGrid for transactional email only.

- **External knowledge** — the WOCAT Global SLM Database and ICARDA's GeOC component are queried live when your team searches for land management alternatives. Trends.Earth is the source of the default degradation layer and the recommended route for preparing a national one.

2. Roles, teams and the planning workflow

LUP4LDN is a collaborative online tool: stakeholders in different organisations team up on a shared planning project. Within each project there are two roles.

	PROJECT OWNER	PROJECT PARTICIPANT
Who	The person who creates the project — usually the lead institution or facilitator.	Anyone invited to the project by the owner.
Defines the region of interest	Yes	No
Chooses input data (LU map, LD map, suitability maps)	Yes	No
Defines the LM assessment indicators	Yes — owner only	Can view them
Defines the LU transition impact matrix	Yes — owner only	Can view it
Defines focus areas	Yes	Yes — all team members can
Assesses current land management	Yes	Yes
Proposes / approves SLM alternatives	Yes	Yes
Builds LU transition scenarios	Yes	Yes

WARNING

The indicators and the transition matrix can be changed **only by the project owner**, and each project has its own separate list of indicators. Agree both with the team before the owner locks them in — changing them mid-workshop invalidates assessments already saved.

2.1 The LUP4LDN user journey

The tool was designed around a user journey map built with planners themselves, so that each function lines up with a real step of an institutional LUP process. Figure 2 shows that map. Figure 3 shows the information flow behind it — which external data sources feed each stage, and where the participatory work sits.

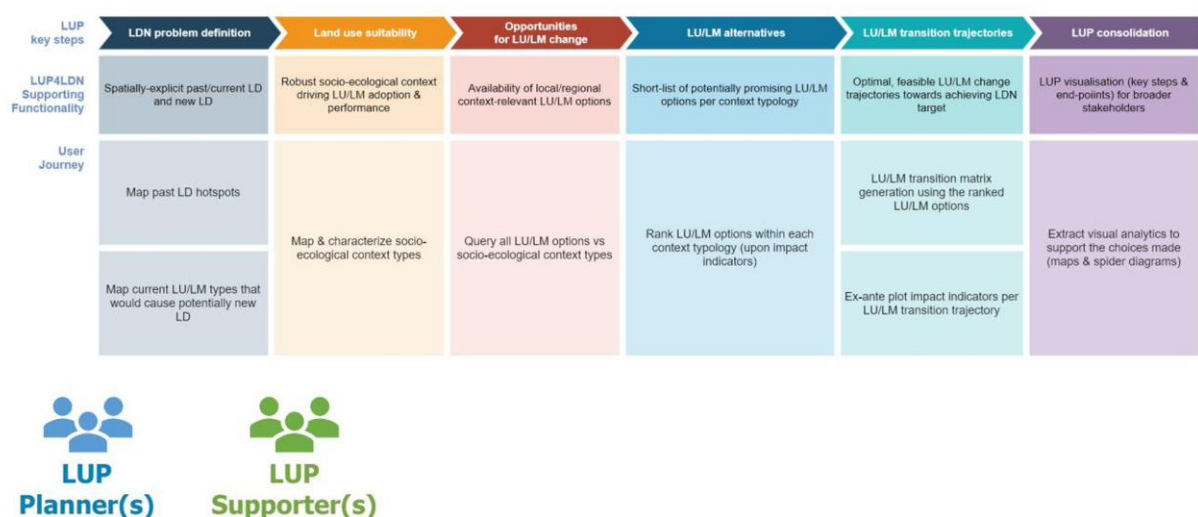


Figure 2 — The LUP4LDN user journey map: how the tool's functions map onto the steps of an institutional land use planning process, and which role acts at each step.

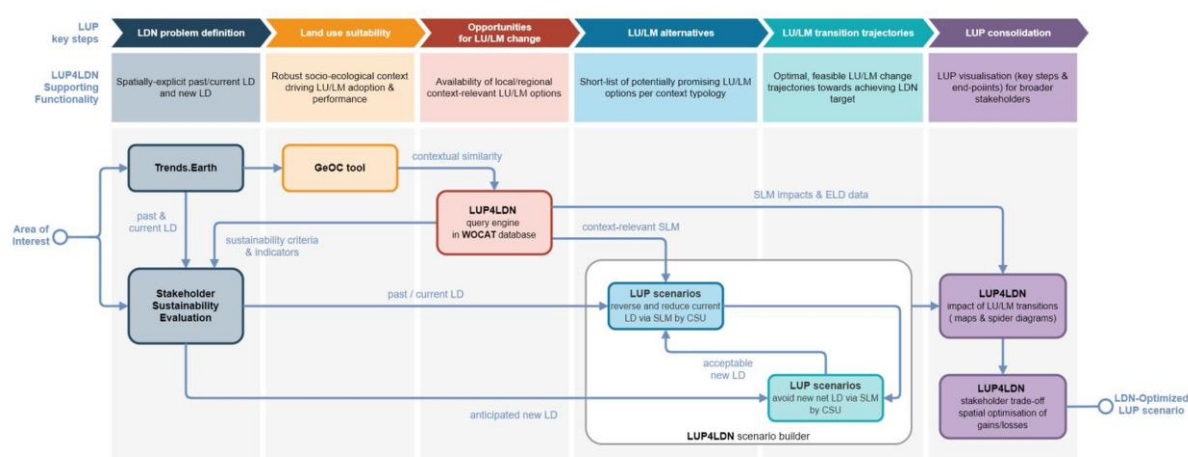


Figure 3 — The LUP4LDN logical flow: where the input data come from, where participatory work happens, and how the pieces combine into an LDN-optimised scenario.

LUP step	What LUP4LDN gives you	Where in this guide
Setting the baseline	Past / current land degradation, spatially explicit, from SDG 15.3.1 data	Sections 3 and 5
LDN problem definition	A defined region of interest and its degradation pattern	Section 5
Land use suitability	Land use mapped against suitability, driving LU adoption and performance	Section 6
Opportunities for LU/LM change	Anticipated new degradation and hotspots; local context-relevant options	Sections 6 and 7
LU/LM alternatives	A short-list of context-relevant SLM options from the WOCAT database	Section 9
LU/LM transition trajectories	Feasible LU/LM change trajectories towards the LDN target	Sections 8 and 9
LUP consolidation	Neutrality matrix and map, plus radar diagrams for broader stakeholders	Section 10

3. Preparing your data

You can run LUP4LDN entirely on its built-in global datasets. You will get far more useful results if you bring national or local data. This section lists what the tool accepts, in which format, and what is mandatory. Full provenance for every default layer is in **Annex A**.

3.1 What you can bring

Input	Format	Required?
Land degradation map (SDG 15.3.1-consistent)	Raster, GeoTIFF (.tif)	Optional — a global default is provided
Land use map	Raster, GeoTIFF (.tif)	Optional — a global default is provided
Land suitability map(s)	Raster, GeoTIFF (.tif)	Mandatory if you upload a custom land use map — at least one class
Region of interest polygon	Vector, GeoJSON	Optional — or pick an administrative area in the tool
Focus area polygon(s)	Vector, GeoJSON	Mandatory — one file per focus area
LU transition area polygon(s)	Vector, GeoJSON	Optional — but required to get scenario results as a map rather than only a table

3.2 Preparing a land degradation map

If you have national degradation data, it must follow the UNCCD Good Practice Guidance for SDG indicator 15.3.1 (Version 2.0). The usual route is to run **Trends.Earth** with your own soil organic carbon and NDVI layers and export the resulting degradation map as a GeoTIFF.

NOTE

If you have no such data, LUP4LDN supplies a default land degradation map derived from Trends.Earth, based on ESA CCI land cover, MODIS NDVI and ISRIC SoilGrids soil organic carbon, at 250 m resolution. See Annex A for full provenance.

3.3 Preparing a land use map and its suitability maps

A custom land use map is a classified GeoTIFF. When you upload it you must declare each class twice — by **NAME** and by the **VALUE** that class carries in the raster. Get these exactly right; a mismatch is the single most common setup failure.

For at least one of those classes you must also upload a **suitability map**: a GeoTIFF expressing where that land use is suitable, coded as follows.

Value	Meaning
0	Neutral, or no data
1	Suitable
2	Marginally suitable

Value	Meaning
3	Not suitable

A land capability map, or another prescriptive map (erosion or salinisation risk associated with a given use), can also be used as an evaluation map — but you must state clearly which land use class, or group of classes, it applies to.

TIP

You need as many suitability maps as there are land use types where degradation is actually known to occur on the ground. Start with those; you do not have to cover every class.

3.4 Preparing polygons (RoI, focus areas, transition areas)

All polygons are uploaded as **GeoJSON**. Two rules apply throughout:

- Every focus area must lie **inside** the region of interest.
- Each focus area goes in its **own** GeoJSON file — though a single focus area may contain several polygons.

If you have standard administrative boundaries, do not prepare anything: LUP4LDN carries GADM polygons down to level 2 and you can pin your RoI directly in the interface.

TIP

Validate every GeoJSON before you upload it by dragging it into **geojson.io**. Two minutes there saves an hour of debugging in a workshop.

Converting a shapefile to GeoJSON in QGIS

- 01** Open **QGIS**.
- 02** In the **Layer** menu choose **Add Layer** → **Add Vector Layer** (shortcut Ctrl+Shift+V).
- 03** In the **Vector Dataset(s)** field click the ... button, browse to your file (.shp or a .zip) and select it.
- 04** Click **Add**, then **Close**.
- 05** In the **Layers** panel on the left, right-click the imported layer.
- 06** Choose **Export** → **Save Features As...**
- 07** In **File name**, set the output path and file name.
- 08** In **Format**, choose **GeoJSON**.
- 09** Click **OK**. The GeoJSON file is written to the path you chose.

3.5 The default global datasets

If you supply nothing, the tool falls back on the datasets below. **Annex A** gives the full metadata for each: producer, licence, resolution, coordinate reference system, temporal coverage and processing lineage.

Dataset	Used as	Source / resolution
SDG 15.3.1 sub-indicators and combined LD indicator	Default baseline “Past LD” map	Trends.Earth — 250 m

Dataset	Used as	Source / resolution
Land Use Systems of the World (LUS)	Default land use map, used to anticipate “New LD”	FAO — 5 arc-min
Combined suitability for pasture and rainfed crops	Default land suitability maps	FAO-IIASA — 5 arc-min
Global Land Use Systems (GLUS)	Optional global contextual similarity unit map	VU Amsterdam — 5 arc-min
Global Land System Archetypes (GLSA)	Optional global contextual similarity unit map	UFZ — 5 arc-min
Functional Context Socio-ecological Types (fCSETs)	Regional / national contextual similarity unit map	ICARDA — 1 km (Tunisia, Algeria, Morocco, Ethiopia, Kenya, Uzbekistan)
Global Administrative Area Database (GADM)	Administrative units available as RoI	GADM — vector, to level 2

WARNING

The global defaults are 5 arc-minute in places — useful for national comparison and for a first look, but generally **too coarse for local decision-making**. Say so explicitly when you present results built on defaults.

4. Getting started: account, project, team

Goal of this phase: everyone who will take part has an account, the project exists, and the team is inside it.

4.1 Prerequisites

- A current desktop browser (Chrome, Firefox, Edge or Safari). The tool is not designed for phones.
- A valid email address for each team member.
- Your prepared data files, if any (Section 3).
- For everyone: at least a shared understanding of the LDN response hierarchy — avoid, reduce, reverse.

4.2 Sign up and log in

- 01** Go to <https://app.landusetool.org>. Registration for the Community version is free and open.
- 02** Choose **Sign up** and complete the registration form. Every member of the team — owner and participants alike — needs their own account.
- 03** Log in with your account.

NOTE

An account is needed because the whole method is collaborative: the owner invites participants, and participants approve each other's proposals. LUP4LDN stores only your first name, last name and email address. Section 13 explains what is held, why, and how to have it deleted.

New User Registration

First name Please fill in your first name.

Last name Please fill in your last name.

Email Please fill in your email address.

Repeat email

Password The password must be more than 8 characters in length.

Repeat password

☐ I accept the terms and conditions

Figure 4 — Registration and login.

4.3 Create the project (project owner)

- 01 In the left-hand menu choose **New Project**.
- 02 Give the project an indicative **Title**, **Acronym** and **Description**, then click **Create Project**.
- 03 You are taken to your **Dashboard**, which lists every project you are involved in.

Figure 5 — Creating a new project.

Project Title	Project Acronym	Project Description	Actions
Project 2	DESCA		Load Project [Grey] [Green] [Red]
SCIO Test Project	SCIO_FULL	This is just a test project to test the system	Load Project [Grey] [Green] [Red]
Lake Sevan Basin	Sevan		Load Project [Grey] [Green] [Red]

Project Title	Project Acronym	Project Description	Actions
No projects found			

Figure 6 — The Dashboard — projects you own and projects shared with you.

4.4 Invite the team (project owner)

- 01 On the Dashboard, find your project row and click the grey **people** button on the right.
- 02 Add the other members of the project and send the invitations.

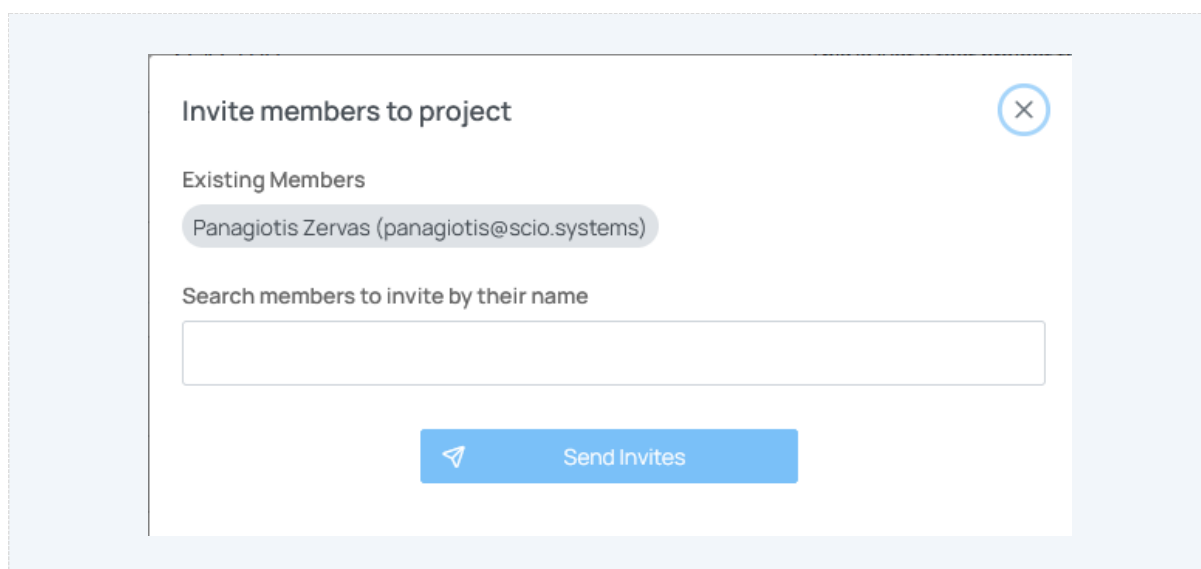


Figure 7 — Inviting project participants.

4.5 Accept an invitation (project participant)

- 01** When a project owner invites you, a notification appears on the **bell** icon next to **Account Settings**.
- 02** Open the notification and **accept** the invitation.
- 03** The project now appears on your **Dashboard** under **Shared Projects**.

NOTE

Two things surprise new users here. First, if you do not see the notification, simply **refresh the page** (or log out and back in later). Second, an accepted project only becomes available to **Load** once the project owner has finished the data setup in Section 5.

5. Setting the context: region and baseline maps

Goal of this phase: the project knows where it is working and which maps it is working from. This is done by the **project owner** only.

5.1 Define the region of interest

- 01** On the Dashboard, click **Continue Setup** for your project.
- 02** Either pin a **Country / Region of Interest** from the administrative units offered, **or** upload your custom RoI polygon as GeoJSON.
- 03** Click **Save Changes** to continue.

Administrative units come from GADM and are available down to level 2 (district or equivalent). Choose an administrative RoI when you need to align with policy implementation; choose a biophysical RoI, such as a watershed, when you want the landscape-based approach and the “like for like” principle to work cleanly.

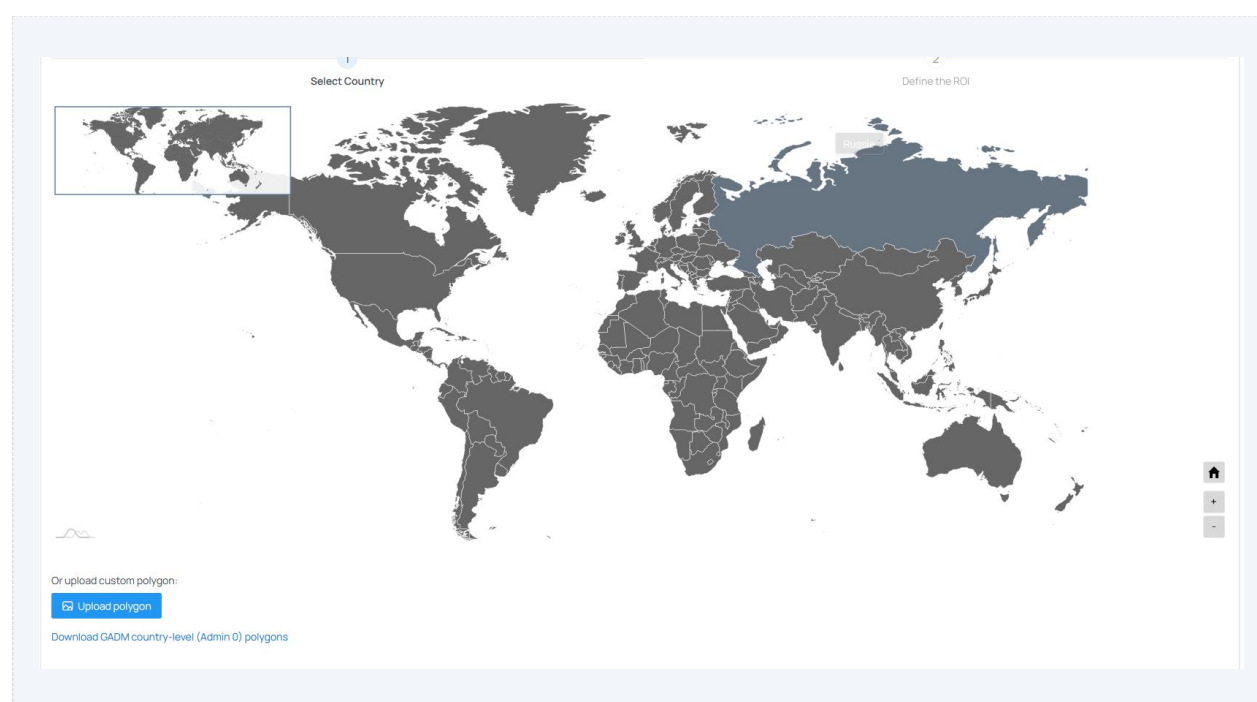


Figure 8 — Pinning the region of interest.

5.2 Choose the land use and land degradation maps

- 01** Select the appropriate options for the **Land Use map** and the **Land Degradation map** — either the tool defaults or your own uploads.
- 02** If you use a custom **Land Use map**, declare each land use class by giving its **NAME** and the **VALUE** it takes in the raster.
- 03** Upload a **Suitability map** for at least one of the classes you declared. This is mandatory when a custom land use map is used.

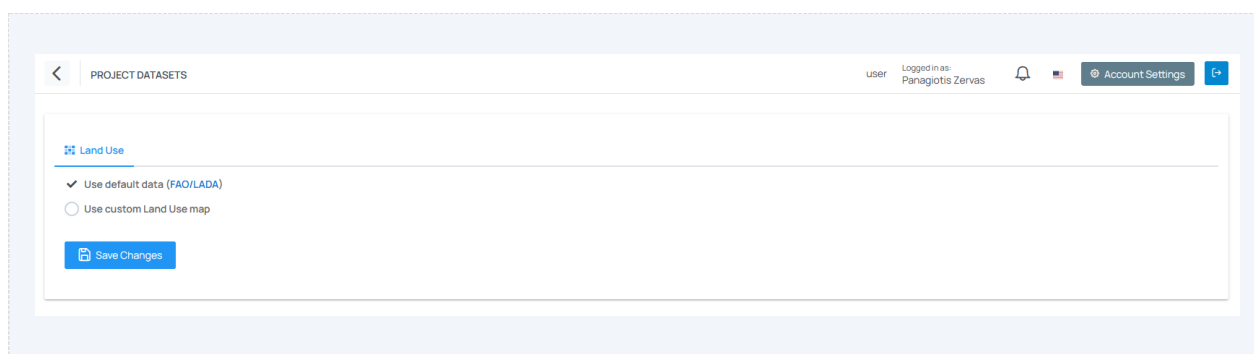


Figure 9 — Selecting the baseline maps and declaring custom land use classes.

WARNING

Only when this setup is complete do participants get access to the project. If your team is sitting in a workshop waiting to load the project, this is almost always the step that is still open.

6. Reading the current state

Goal of this phase: understand where degradation already is, where it is likely to appear next, and therefore where to intervene. This is the first round of participatory work.

6.1 Land use versus suitability

- 01 Navigate to **Current State** and open the **Land Use Suitability** tab.
- 02 Examine the current land use of the region of interest alongside the suitability of the corresponding land.

You can download the maps from LUP4LDN as GeoTIFF files at any point and work on them in your own GIS software.

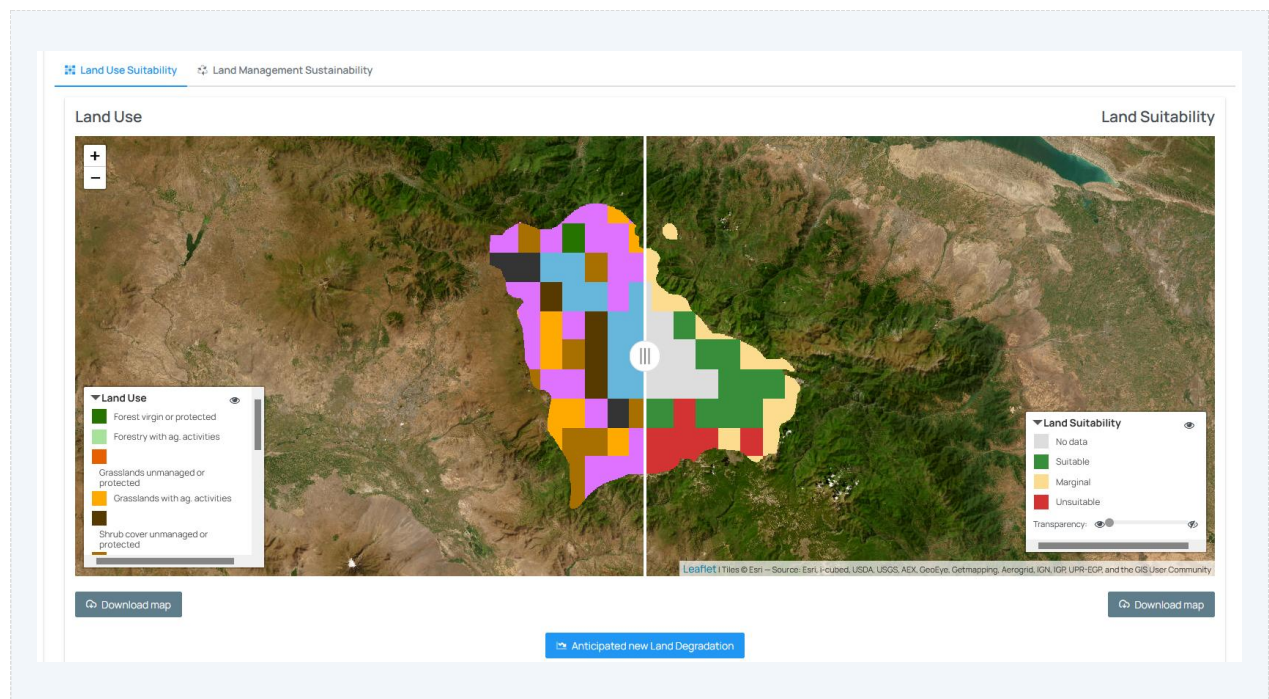


Figure 10 — Current land use against land suitability.

6.2 Anticipate new land degradation

- 01 Click **Anticipated new Land Degradation**.
- 02 Inspect how the suitability of each land use affects degradation, and examine the hotspots.

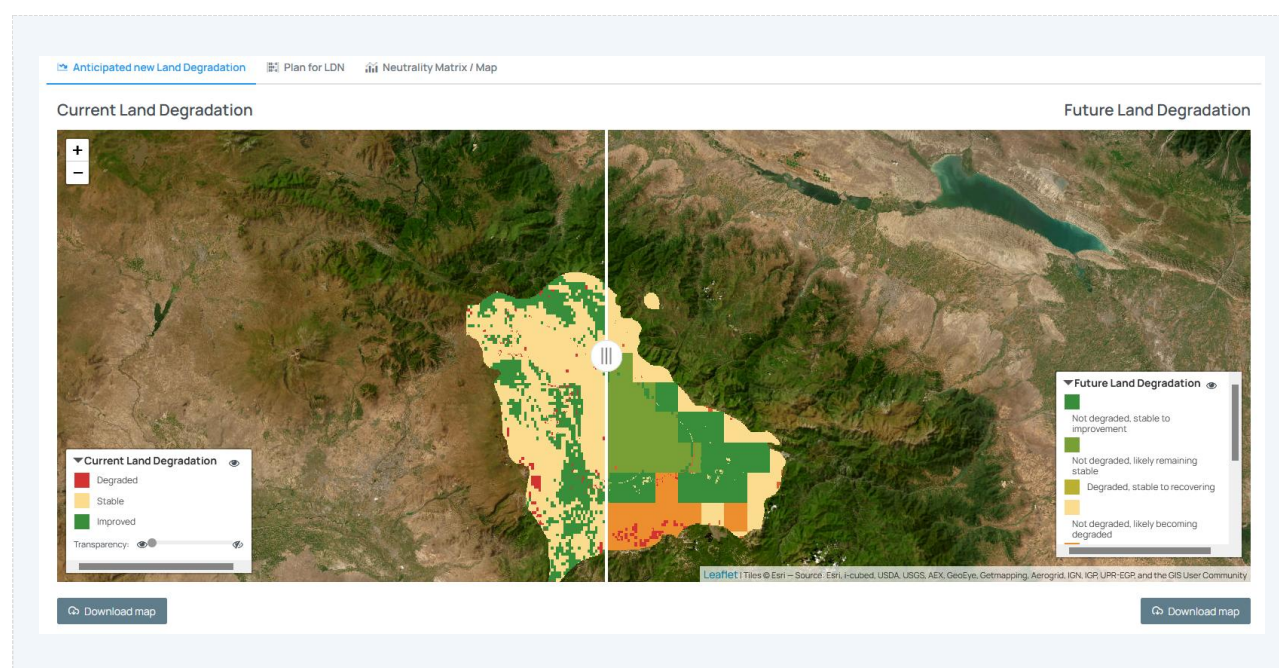


Figure 11 — Land degradation in the region of interest, with the swipe control comparing two layers.

The logic behind this map is simple and deliberately transparent: where a land use is being practised on land that is not suitable for it, that land is expected to degrade during the planning period. It is an overlay, not a simulation — which is exactly why the quality of your suitability maps matters so much (see Section 1.3).

6.3 Decide where to act

From the hotspots, your team decides which areas could realistically:

- **(A) change their land use** — these become your **LU transition areas**, planned at RoI level; or
- **(B) change their land management** under the same land use — these become your **Focus Areas**.

TIP

This is the natural point for a structured group discussion. Record the decision as a simple table — SLM practice, land use class, priority rank, and the share of each unit to be treated within 5, 10 and 15 years — which is how the Tunisian and Burkina Faso stakeholder groups did it during piloting.

7. Evaluating current land management

Goal of this phase: for each focus area, judge how sustainable the land management currently in place actually is. Everything in Section 9 depends on this being done at least once.

7.1 Agree the assessment indicators (project owner)

01 Go back to **Current State** and open the **Land Management Sustainability** tab.

02 Define the indicators that the project will use to assess different SLM technologies for a given land use in a focus area.

Participants cannot change this list — they can only view it. Each project carries its own separate set of indicators.

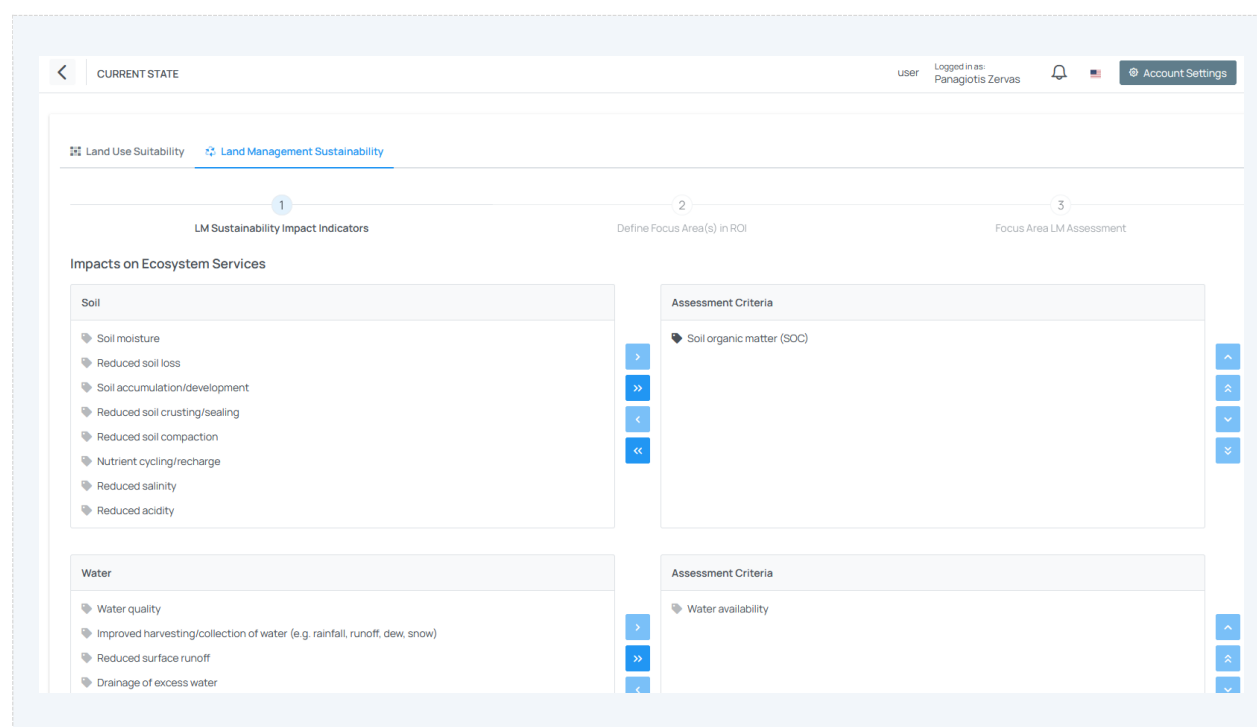


Figure 12 — Defining the assessment indicators.

The tool offers over seventy indicators, grouped in three categories and eight ecosystem-service domains. Pick only what is relevant to your case — the three SDG 15.3.1 sub-indicators are always included automatically.

Category	Indicators	Domains covered
SDG 15.3.1 sub-indicators	3 (always included)	Soil organic carbon, land cover, land productivity
Ecological impacts	35	Soil; water; biological resources; climate change resilience
Economic impacts	22	Production; economic viability (including ELD indicators: NPV, cost-benefit ratio, return on investment, total economic value)
Sociocultural impacts	10	Food security and health; equality of opportunities

NOTE

The tool asks you to score indicators; it deliberately does not prescribe how to measure them. It will not tell you how to quantify “reduced risk of production failure” — you apply whichever metric, method or dataset fits your local context, data availability and capacity.

7.2 Define focus areas (any team member)

- 01** Enter a **NAME** for the focus area.
- 02** Click **Select file** and upload the focus area polygon as GeoJSON.
- 03** Click **Add**.
- 04** Wait until the focus area appears in the **Focus Areas** table on the right. Do not proceed before it is listed.

Order matters: name first, then file, then Add. Each focus area needs its own GeoJSON file, and must sit inside the region of interest.

Figure 13 — Adding a focus area.

7.3 Assess the land management in place

- 01** Once at least one focus area exists, use the interface to evaluate, for each focus area and each land use type within it, the land management approach currently adopted.
- 02** Score the selected indicators on the seven-point scale from **−3** to **+3** (see below).
- 03** Click **Save Assessment** when you finish an evaluation.

You do not have to assess everything. Assess as many land management / focus area combinations as you have genuine knowledge of — and only those. You can save and return later.

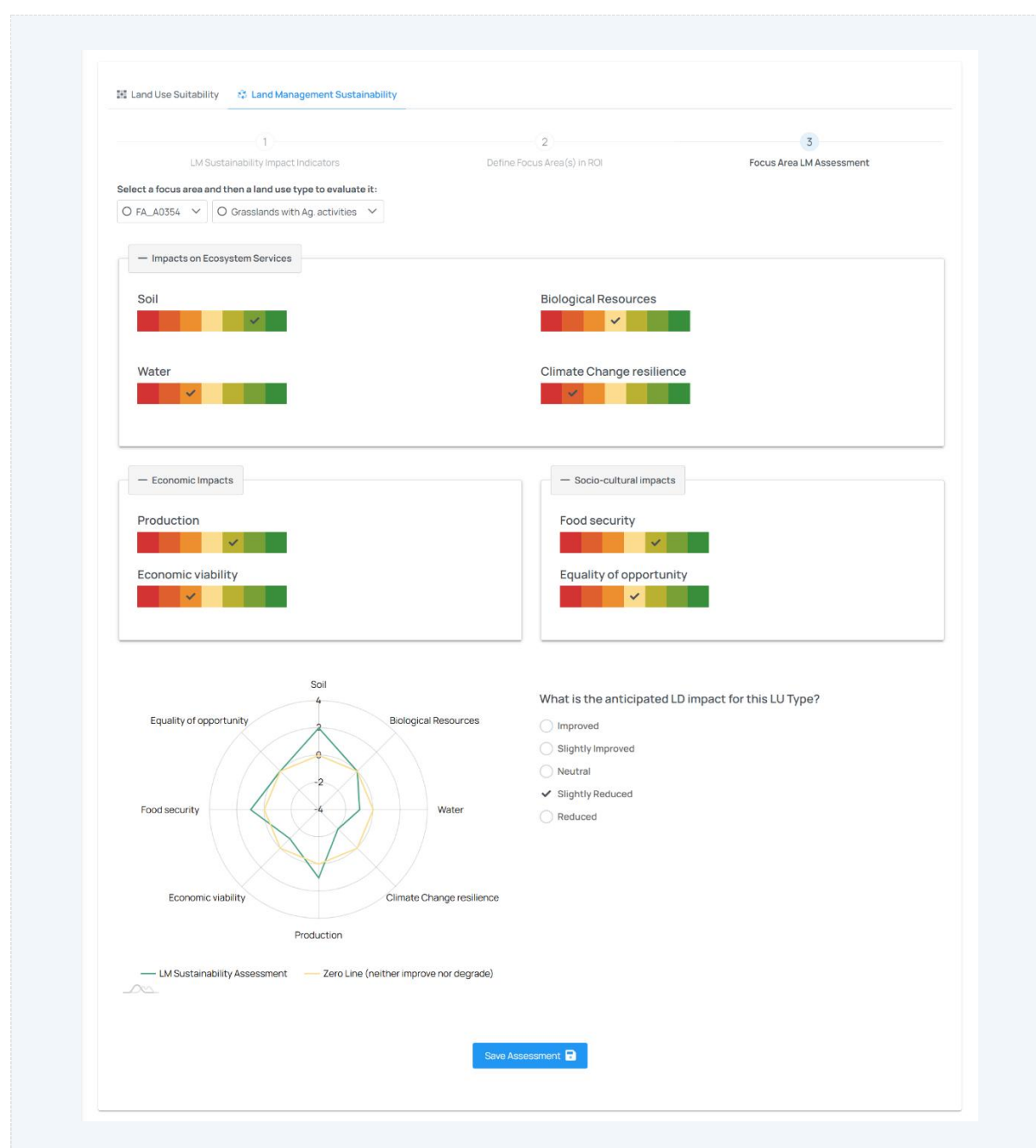


Figure 14 — Scoring impacts by ecosystem-service domain. The radar diagram compares the current LU system (green) against the system implementing the selected SLM (blue).

Score	Meaning
+3 / +2 / +1	Positive impact: more than 50% / 20–50% / 5–20% expected increase in ecosystem service provision
0	Negligible impact
–1 / –2 / –3	Negative impact: 5–20% / 20–50% / more than 50% expected decrease in ecosystem service provision

WARNING

If you leave the assessment without pressing **Save Assessment**, the scoring is lost. In a workshop, make one person responsible for saving after each group decision.

8. Planning land use transitions

Goal of this phase: express your plan as concrete land use changes over time, and see what they do to the degradation balance.

8.1 Set the LU transition impact matrix (project owner)

01 Navigate to **Land Use Planning** and open the **Plan for LDN** tab.

02 Set up the **LU Transition Impact Matrix**, which describes the effect on land degradation of each land use change.

For every possible combination of current versus future land use type, assign a value: positive, neutral or negative. Participants can inspect the matrix but only the project owner can modify it.

	Tree-covered	Grassland	Cropland	Wetland	Artificial area	Bare land	Water body	
Tree-covered	+	-	-	-	-	-	+	
Grassland	+	-	+	-	-	-	-	
Cropland	+	-	-	-	-	-	+	
Wetland	-	-	-		-	-	+	
Artificial area	+	+	+	+	+	+	+	
Bare land	+	+	+	+	-	-	+	
Water body			+	+	+	+	+	

Figure 15 — The LU transition impact matrix — each cell is set to positive (green), neutral (yellow) or negative (red).

TIP

Fill the matrix as a group exercise, out loud. Disagreement about whether, say, rangeland-to-cropland is negative in your context is exactly the discussion the tool is there to provoke — and it is far cheaper to have it now than after the scenarios are built.

8.2 Build transition scenarios

01 Click **New Scenario**.

02 For each land use type, specify the envisioned change in **hectares**.

03 If you know **where** each change will happen, click the **upload** button next to that change and upload the multi-polygon GeoJSON. LUP4LDN then calculates the surface in hectares for you.

04 Click **Save Changes** before you continue or define the next scenario.

2025 - 2030			▼ Collapse	Save Changes
Land Type	2025	2030		
> Tree-covered	128,304.00 ha	128,304.00 ha		
> Grassland	270,585.00 ha	270,585.00 ha		
> Cropland	70,731.00 ha	70,731.00 ha		
> Wetland	1,071.00 ha	1,071.00 ha		
> Artificial area	6,246.00 ha	6,246.00 ha		
> Bare land	1,629.00 ha	1,629.00 ha		
> Water body	155,664.00 ha	155,664.00 ha		

Figure 16 — A land use transition scenario. Expanding a land type reveals what it BECOMES, with the hectares and the Map / upload controls for the corresponding polygons.

How scenarios behave

- Scenarios are **consecutive**, starting from the tool's current baseline year and running up to the 2030 horizon of SDG target 15.3.
- Each scenario builds on the one before it — they are a sequence, not alternatives sitting side by side.
- Without polygons you still get results, but only as a matrix or table. **With** polygons you get the scenario as a map.

WARNING

Do **not** edit an earlier scenario once later ones exist. Because scenarios are consecutive, altering one mid-chain produces inconsistent results. The safe procedure is: delete every scenario after the one you want to change, change it, then rebuild the chain.

The scenarios let you work around the LDN response hierarchy. One scenario might aim at 100% avoidance of new degradation by changing the unsustainable land uses — the ideal, perfectly neutral case. Another might avoid 70% of new degradation and counterbalance the remaining 30% by improving management on land already degraded. Scenarios with a negative balance are possible too, and are often the most instructive to show a ministry.

9. Choosing land management alternatives

Goal of this phase: find and agree, as a team, the SLM practices that will replace the unsustainable management you scored in Section 7.

WARNING

This functionality only appears once you have evaluated the adopted land management for **at least one land use in at least one focus area** (Section 7.3). If you cannot see the **Land Management** option, that is why.

9.1 Search WOCAT for an alternative SLM

- 01 Under the **Plan for LDN** tab, open the **Land Management** option.
- 02 Select an already-evaluated land use under the focus area you want to work on.
- 03 Use the interface to search **WOCAT** for an appropriate SLM alternative.

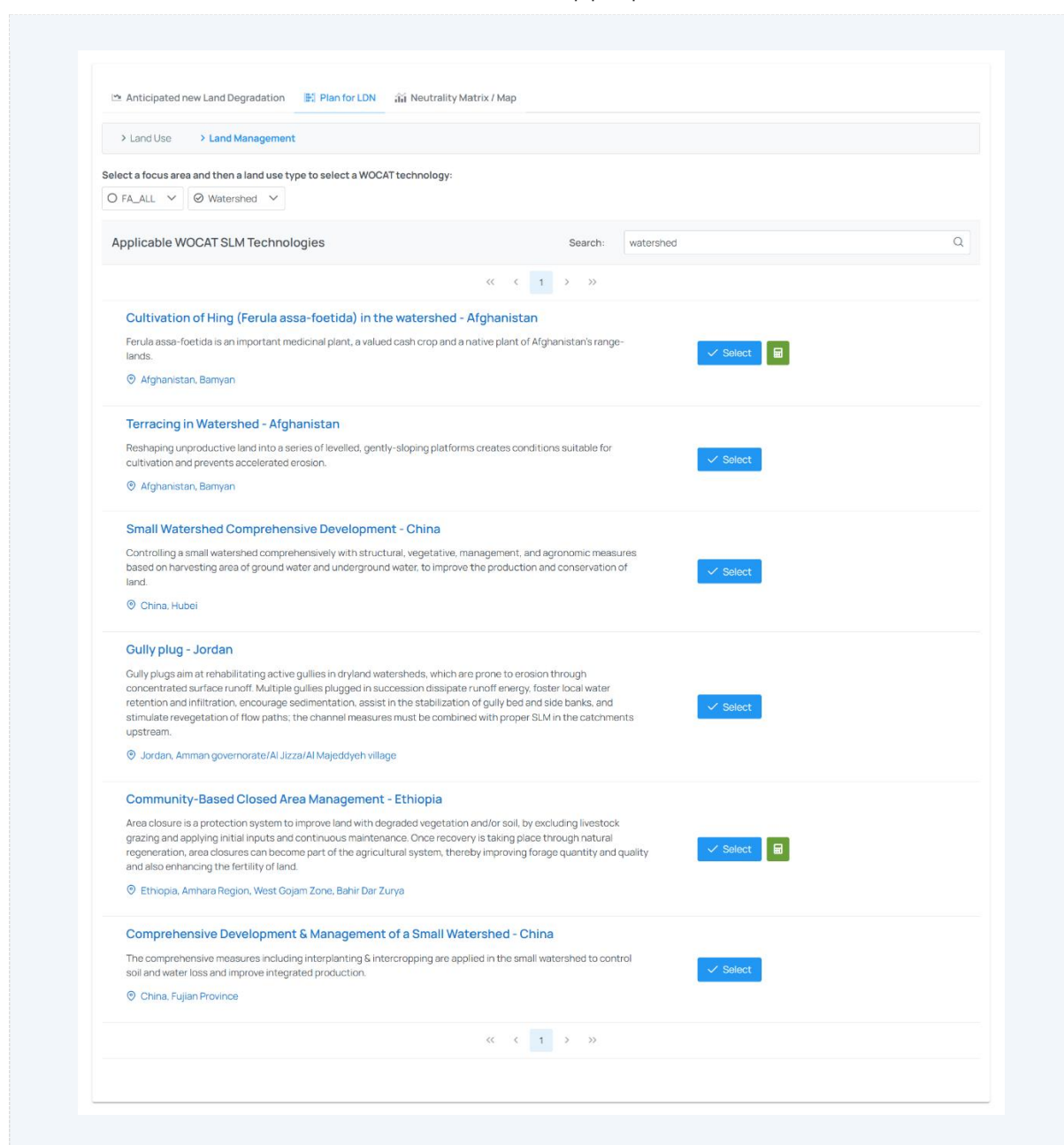


Figure 17 — Searching the WOCAT global SLM database from inside LUP4LDN.

The WOCAT Global SLM Database holds over 1,200 georeferenced SLM technologies. LUP4LDN's GeOC component narrows these to technologies documented in areas belonging to the same contextual similarity unit as your region — so the short-list can include practices proven in other countries with comparable socio-ecological conditions. Where there is no spatial overlap between the WOCAT records and your context units, search the WOCAT database online directly.

For the available list of SLMs within LUP4LDN, fetched from the World Overview of Conservation Approaches and Technologies (WOCAT) database, the costs and benefits of SLMs are retrieved from the [ECON-WOCAT dataset](#).

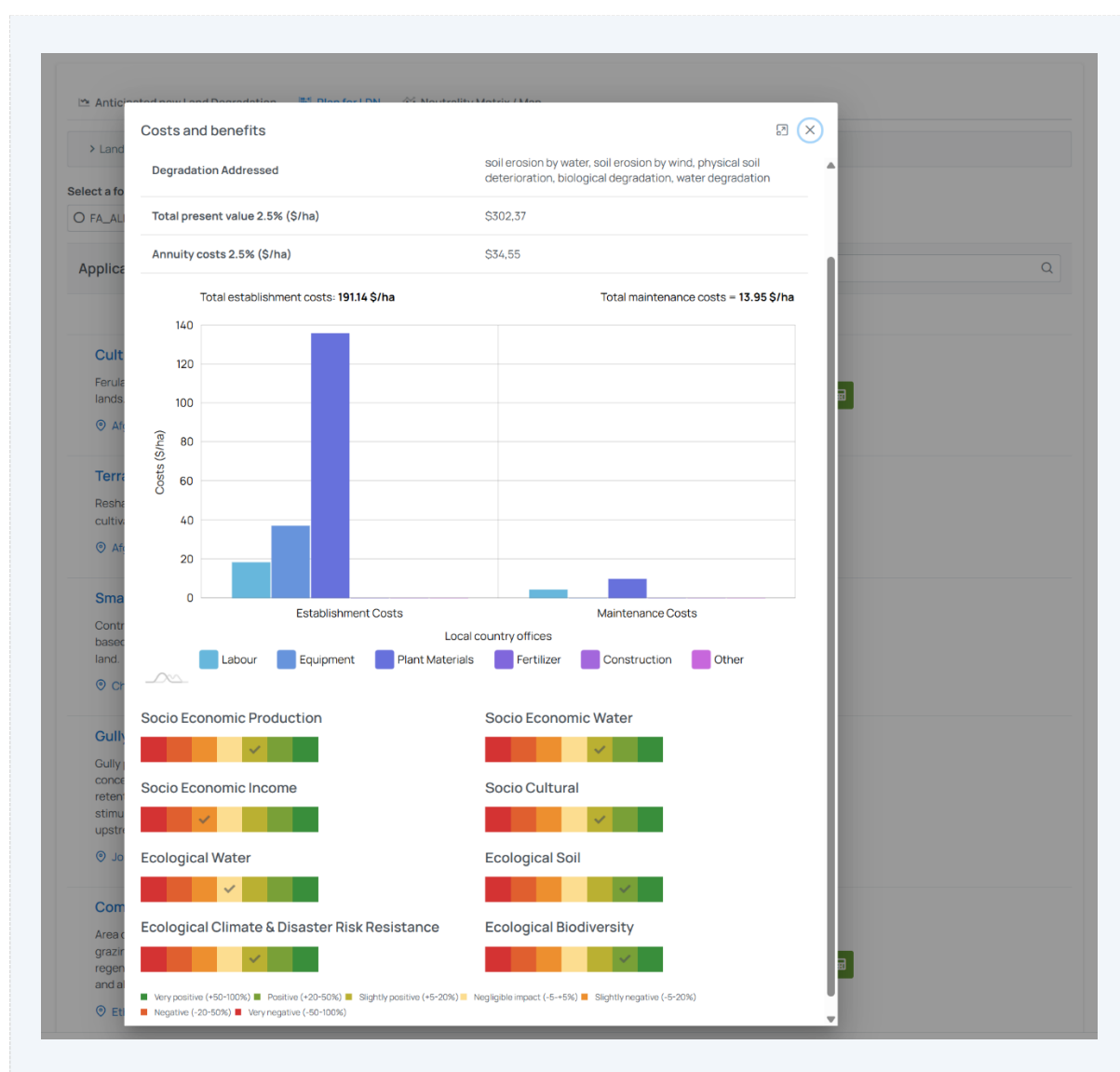


Figure 18 — Cost and benefits from selected WOCAT SLM

9.2 Propose, review, agree

The proposal cycle is deliberately consensual:

- 01 The first user** to find a suitable WOCAT alternative proposes it to the team.
- 02 Every other team member** who has evaluated the same land use under the same focus area sees the proposal when they open it.
- 03** Each of them checks the alternative by clicking its title to open it on WOCAT, and then **approves** or **rejects** the proposal.

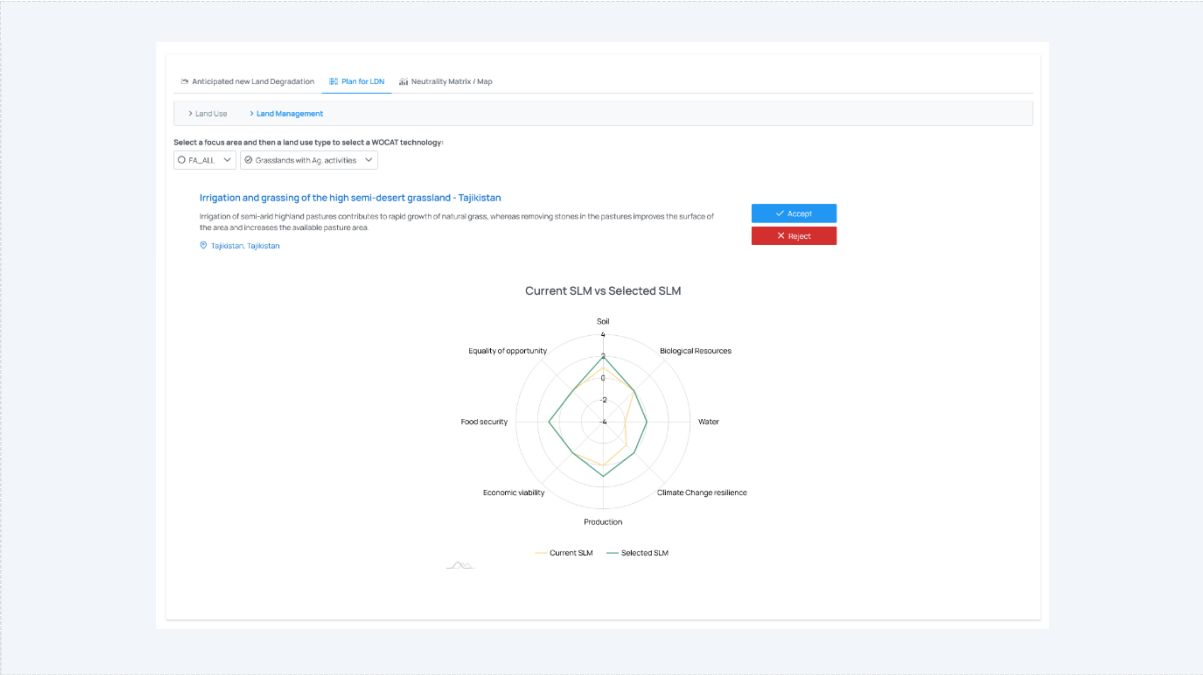


Figure 19 — Reviewing a proposed SLM alternative.

Outcome	What happens
At least one team member rejects	The proposal is discarded. Any team member may then suggest a different alternative.
All team members who assessed that land use approve	The SLM is locked and becomes the group's agreed choice for that land use in that focus area.

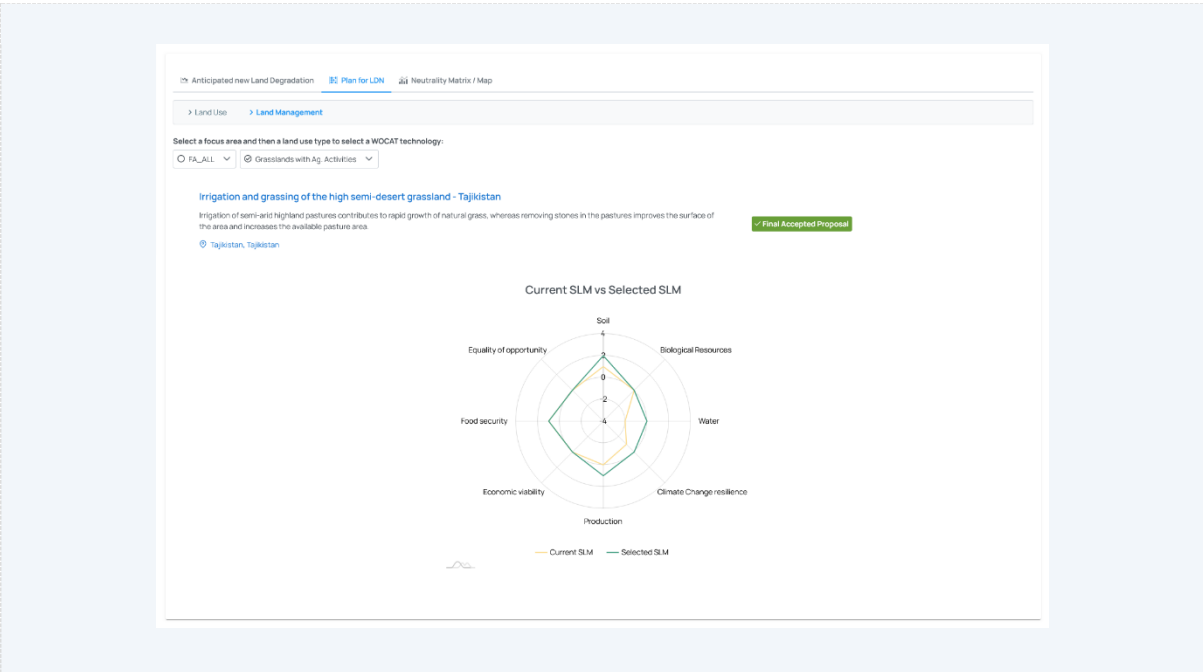


Figure 20 — Group's agreed choice for that land use in that focus area.

NOTE

You are not restricted to what the tool suggests. If your team has a local or traditional practice that fits better than anything in the database, you can use it to formulate the transition trajectory.

10. Consolidating the plan

Goal of this phase: see the whole plan as one balance, and adjust it until it holds.

- 01** Navigate to the **Neutrality Matrix / Map** tab under the **Land Use Planning** menu.
- 02** Examine the consolidated results of the group's plan.
- 03** Calibrate: either alter the **last** LU transition scenario, or start over with different planning hypotheses.

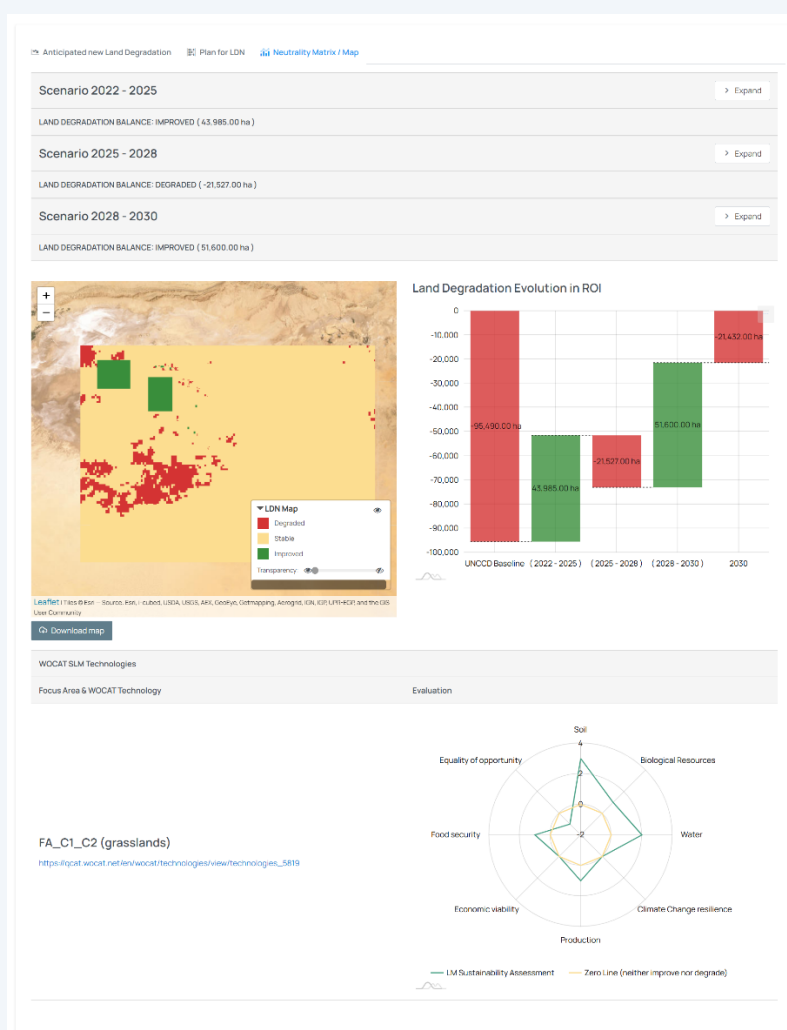


Figure 21 — The consolidated result: the land degradation balance for the scenario, the Neutrality Map button, and the degradation evolution across the planning periods.

Read the result against the LDN framework: neutrality means that losses of land-based natural capital during the planning period are prevented, or else counterbalanced by equivalent gains from reducing or reversing degradation inherited from the past — and, for accountability, within like land types.

TIP

Run at least three scenarios and present them together: a business-as-usual case, an ambitious case, and the one your team believes is actually feasible. The comparison is what makes the trade-offs visible to decision-makers, and it is the tool's main contribution to a policy conversation.

11. What you can take out of the tool

All output maps are GeoTIFF rasters, so anything you generate can be taken into QGIS or another GIS for further analysis. Annex A records the metadata for each output.

Output	What it contains
"Past" (baseline) land degradation	Map of land degraded, improved or stable during the baseline period, plus a table of hectares by map unit and land use type.
"New" (anticipated future) land degradation	Map of land expected to degrade, improve or stay stable during the future assessment period, plus the corresponding table.
Default "New" land degradation	The same, derived from the tool's default land use and suitability maps, plus table.
Overall (Past + New) degradation	A nine-class map combining past and new units, plus table.
LU transition scenarios	Scenario maps showing the overall degradation map updated for land improved by land use change, plus the scenario table.
LM transition scenarios	Scenario maps showing the effect of introducing SLM practices in focus areas, a table by focus area and land use type, and radar diagrams comparing planned SLM against current management.

12. Common pitfalls and troubleshooting

Symptom	Cause	Fix
A participant accepted the invitation but cannot Load the project.	The project owner has not finished the data setup.	The owner completes Section 5 (Rol and maps). The project then becomes loadable.
No invitation notification appears on the bell icon.	The page has not refreshed since the invitation was sent.	Refresh the page, or log out and log back in later.
A focus area does not appear in the Focus Areas table after clicking Add .	Processing has not finished, the polygon falls outside the Rol, or several focus areas were put in one file.	Wait for it to be listed; confirm the polygon is inside the Rol; use one GeoJSON file per focus area.
The Land Management option is missing under Plan for LDN .	No land management has been assessed yet.	Assess at least one land use in at least one focus area (Section 7.3).
A custom land use map produces no or wrong results.	Class NAME/VALUE declarations do not match the raster, or no suitability map was uploaded.	Re-declare each class with its exact raster value and upload a suitability map for at least one class.
Scenario results come out only as a table, with no map.	No polygons were uploaded for the land use transitions.	Upload a multi-polygon GeoJSON for each transition you can locate spatially.
Numbers look inconsistent after editing an older scenario.	Scenarios are consecutive and cumulative.	Delete every scenario after the one you want to change, then re-enter them in order.
A shapefile will not upload.	The tool accepts GeoJSON for vector data.	Convert it in QGIS (Section 3.4) and validate on geojson.io .
An assessment or scenario was lost.	Save Assessment / Save Changes was not pressed.	Re-enter and save. Assign one person to save after every group decision.
Indicators or the transition matrix cannot be edited.	Both are restricted to the project owner.	Ask the project owner to make the change — ideally before assessments begin.
Results look implausibly coarse.	The project is running on the 5 arc-minute global default datasets.	Bring national land use and suitability data, or state the resolution limitation when presenting.

NOTE

If your problem is not here, please report it — see Section 14. A reported problem becomes a documented fix for the next team.

13. Privacy and your personal data

LUP4LDN needs accounts because the method is collaborative: a project owner invites participants, and participants approve each other's proposals. Beyond what that requires, the tool collects as little as possible.

	What LUP4LDN does
What is collected	First name, last name and email address, provided at registration. The planning projects, scenarios and inputs you create or upload. Standard web server logs (IP address, browser type, access times) for security and reliability.
What is never collected	No special category data — no health, biometric or similarly sensitive personal data. No advertising or profiling trackers.
Why	To create and secure your account, to save and retrieve your planning projects, to respond to support requests, and to report anonymised and aggregated usage statistics to funders and partners.
Where it is held	Amazon Web Services (Lambda, S3). Transactional email — invitations and account mail — is delivered through SendGrid.
How long	For as long as your account is active. Inactive accounts are deleted or anonymised after 24 months.
Your rights	Access, correction, export, deletion, and objection to or restriction of certain processing. Write to lup4ldn@scio.systems .
Data controller	SCiO Private Company (SCiO P.C.), P. Grigoriou and Neapoleos Str., GR-15310, Agia Paraskevi, Greece.

The full policy is published at <https://www.landusetool.org/privacy-policy/> and is the authoritative version; this section is a summary.

NOTE

Security issues are handled separately from privacy questions. If you believe you have found a vulnerability, please follow **SECURITY.md** in the repositories and email lup4ldn@scio.systems — do not open a public issue.

14. Support, feedback and contributing

LUP4LDN is maintained by SCiO and developed in the open. There are three different doors, depending on what you need.

If you want to...	Go to	What to expect
Ask a question about using the tool	lup4ldn@scio.systems	A reply from the maintaining team. SCiO also offers consultations and tailored training packages.
Report a bug	GitHub Issues on the relevant repository	Include what you expected, what happened, the steps to reproduce and your environment. See CONTRIBUTING.md for the full template.
Ask other users, or answer them	GitHub Discussions	A public space for planning teams to share practice, with input from the development team.
Propose a change to the code	A pull request	Open an issue first for anything non-trivial. Fork, branch from main, follow the existing style, add tests, and open a PR against main. A maintainer reviews it.
Report a security vulnerability	lup4ldn@scio.systems , privately	Acknowledgement within 5 business days, then coordinated disclosure. Never open a public issue for this.
Translate this guide	See Annex D	The guide is CC BY 4.0 precisely so that it can be translated.

14.1 Who maintains LUP4LDN

LUP4LDN is maintained by a core team at SCiO P.C. covering backend development, frontend development, geospatial data science and DevOps, so that the loss of any one person does not put the tool at risk. Contributions from outside that team are welcome and are reviewed on the same terms.

NOTE

LUP4LDN is used in active deployments in Tunisia, Burkina Faso and Senegal. Changes to shared endpoints and data formats are reviewed with that in mind, so please allow time for discussion on larger changes.

15. Development roadmap

LUP4LDN is actively maintained. This section states what is planned so that users and prospective contributors can see where the tool is going, and so that no one has to guess whether development has stopped. It is reviewed at each release.

Planned work	What it means	Horizon
Open metadata catalogue	Publish the global default layers as a STAC collection, and expose a STAC item per generated output, so that LUP4LDN data can be discovered and consumed by other tools.	Next release
Tabular exports	Export every results table — hectares by map unit, land use and focus area, and the values behind the radar diagrams — as CSV and JSON alongside the existing GeoTIFF map downloads.	Next release
Account self-service	In-app account deletion, cascading to personal identifiers, with collaborative project content anonymised rather than destroyed.	Next release
Open administrative boundaries	Replace or supplement the GADM administrative layer with an openly licensed alternative, so that every default dataset can be redistributed without restriction.	Under review
French documentation	A French translation of this guide, given the francophone user base in Tunisia, Burkina Faso and Senegal.	Under review
Registration-free demonstration mode	A read-only walkthrough of a worked example, so a prospective user can see the method before creating an account.	Under review

NOTE

Priorities are shaped by what users report. If something on this list matters to your programme — or something missing from it does — say so through the channels in Section 14.

16. Key terms

Term	Meaning
CSU	Contextual Similarity Unit — a spatial class of socio-ecological contexts, used to find SLM options proven in comparable conditions.
ES	Ecosystem Services — the benefits people obtain from land, across environmental, production, economic, human and social domains.
FA	Focus Area — a polygon inside the RoI where land management transitions are planned.
GADM	Global Administrative Areas database — the source of the administrative boundaries offered as regions of interest.
GeOC	Geoinformatics Options by Context — the component that matches SLM options to socio-ecological contexts.
GPG	Good Practice Guidance — the UNCCD methodology for SDG indicator 15.3.1, Version 2.0.
LD	Land Degradation.
LDN	Land Degradation Neutrality — a state where land resources remain stable or increase within specified temporal and spatial scales.
LM	Land Management — how a given land use is practised.
LU	Land Use — what the land is used for.
RoI	Region of Interest — the study region for a project.
SDG 15.3.1	The indicator “proportion of land that is degraded over total land area”, built from three sub-indicators: land cover, land productivity and carbon stocks.
SLM	Sustainable Land Management.
STAC	SpatioTemporal Asset Catalog — an open specification for describing geospatial assets.
Trends.Earth	The tool applying official SDG 15.3.1 guidance, and the source of LUP4LDN's default degradation data.
WOCAT	World Overview of Conservation Approaches and Technologies — the global SLM database queried by LUP4LDN.

17. Further reading and support

- Zucca, C., Le, Q.B., Karampiperis, P., Lemann, T., Thomas, R., Thiombiano, B.A., Hermassi, T., Bonaiuti, E. & Zervas, P. (2024). Toward an operational tool to integrate land degradation neutrality into land use planning: LUP4LDN. **Land Degradation & Development**, 35(7), 2489–2507. doi:10.1002/ldr.5075
- Orr, B.J. et al. (2017). Scientific Conceptual Framework for Land Degradation Neutrality. UNCCD, Bonn.
- Sims, N.C. et al. (2021). Good Practice Guidance. SDG Indicator 15.3.1, Version 2.0. UNCCD.
- UNCCD Science-Policy Interface (2023). Integrated Land Use Planning — see Box 5.1 on LUP4LDN.
- WOCAT Global SLM Database — wocat.net
- Trends.Earth — trends.earth
- QGIS — qgis.org · GeoJSON validation — geojson.io · GADM — gadm.org

Tool: <https://app.landusetool.org> · **About:** <https://www.landusetool.org> · **Source:** <https://github.com/SCiO-systems/lup4ldn>

Need help? Contact SCiO at lup4ldn@scio.systems

Annex A — Data sources and metadata

This annex records, for every dataset LUP4LDN ships and every output it produces, where the data comes from, who produced it, under what terms it may be used, at what resolution, for what period, and how LUP4LDN processes it. It is published so that results generated with the tool can be traced and reproduced.

A.1 Default input datasets

Dataset	Producer	Resolution / CRS	Temporal coverage	Terms of use
SDG 15.3.1 sub-indicators and combined land degradation indicator	Derived with Trends.Earth (Conservation International), from ESA CCI land cover, MODIS NDVI and ISRIC SoilGrids soil organic carbon	250 m EPSG:4326	Baseline and reporting periods as defined by the UNCCD Good Practice Guidance v2.0	Derived product. Underlying sources carry their own terms — ISRIC SoilGrids CC BY 4.0; MODIS NASA open; ESA CCI Land Cover under ESA CCI terms.
Land Use Systems of the World (LUS)	FAO	5 arc-min EPSG:4326	As published by FAO	FAO terms of use
Combined suitability for pasture and rainfed crops	FAO and IIASA (GAEZ)	5 arc-min EPSG:4326	As published in GAEZ	GAEZ terms of use
Global Land Use Systems (GLUS)	VU Amsterdam	5 arc-min EPSG:4326	As published	Academic source
Global Land System Archetypes (GLSA)	Helmholtz Centre for Environmental Research (UFZ)	5 arc-min EPSG:4326	As published	Academic source
Functional Context Socio-ecological Types (fcSETs)	ICARDA	1 km EPSG:4326	As published	ICARDA terms
Global Administrative Areas (GADM), to level 2	GADM	Vector EPSG:4326	Version as bundled	Restricted. GADM states that the data are freely available for academic and other non-commercial use, and that redistribution or commercial use is not allowed without prior permission. See A.4.

A.2 Datasets queried at run time

Service	Producer	Role in LUP4LDN
WOCAT Global SLM Database	WOCAT	Queried live when the team searches for SLM alternatives. Over 1,200 georeferenced SLM technologies. Results are displayed and linked back to the WOCAT record; LUP4LDN does not redistribute the database.
GeOC — Geoinformatics Options by Context	ICARDA	Narrows WOCAT results to technologies documented in areas belonging to the same contextual similarity unit as the region of interest.

Service	Producer	Role in LUP4LDN
ELD Initiative indicator set	Economics of Land Degradation Initiative	Supplies the economic-viability indicators used in the land management assessment: net present value, cost–benefit ratio, return on investment, total economic value.

A.3 Outputs and their lineage

Every output below is downloadable. Rasters are GeoTIFF in the CRS of the inputs; tables are generated per map unit, land use type and focus area.

Output	Format	How it is derived
Past (baseline) land degradation	GeoTIFF raster + table	The land degradation map selected at project setup — either the Trends.Earth-derived default or the national GPG-consistent layer uploaded by the project owner — clipped to the region of interest.
Anticipated new land degradation	GeoTIFF raster + table	Overlay of the land use map against the suitability map(s): land under a use for which it is not suitable is classed as expected to degrade. No process simulation is involved.
Default anticipated new land degradation	GeoTIFF raster + table	The same overlay computed from the tool's default land use and suitability layers, for comparison.
Overall (past + new) degradation	GeoTIFF raster + table	A nine-class combination of the past and new degradation units.
LU transition scenario	GeoTIFF raster + table	The overall degradation map updated for land improved by the land use changes declared in the scenario, evaluated through the LU transition impact matrix set by the project owner. Mapped output requires transition-area polygons.
LM transition scenario	GeoTIFF raster + table + radar diagram	The effect of introducing the agreed SLM practices in the focus areas, from the participants' indicator scores (–3 to +3) for current versus planned management.
Neutrality matrix and map	On-screen matrix + GeoTIFF raster	The consolidated balance of losses and gains across the scenario chain, assessed like for like across comparable land types.

A.4 Known constraint on the administrative boundaries layer

WARNING

The bundled GADM administrative boundaries are published for academic and other **non-commercial** use, and redistribution or commercial use requires prior permission from GADM. If you are deploying LUP4LDN in a commercial context, or redistributing a self-hosted instance that bundles this layer, obtain that permission or substitute an

openly licensed boundary dataset. Replacing this layer is on the roadmap (Section 15).

A.5 Metadata standards

LUP4LDN currently publishes dataset provenance in this human-readable form. A machine-readable **STAC (SpatioTemporal Asset Catalog)** collection covering the default layers, and a STAC item per generated output, is planned for the next release — see Section 15.

Annex B — Conformance with LDN data and quality standards

This annex states explicitly how LUP4LDN relates to the standards that govern LDN tools and data, so that the claim does not have to be inferred from the method description.

Standard	How LUP4LDN relates to it
UNCCD Good Practice Guidance for SDG indicator 15.3.1, Version 2.0	Implements. All degradation reporting is expressed through SDG 15.3.1 and its three sub-indicators — land cover, land productivity and soil organic carbon. National degradation layers uploaded to the tool must be GPG-consistent, and the recommended route for producing them is Trends.Earth, which applies the official guidance.
GEO-LDN Working Group 2 — Minimum data quality standards and decision trees for SDG Indicator 15.3.1 (2020)	Acknowledges and implements. These standards were incorporated into Good Practice Guidance v2.0, which LUP4LDN implements as above. The default degradation layer is a Trends.Earth product, the reference implementation these standards were developed alongside.
GEO-LDN — Minimum Quality Standards for LDN Tools and Data (GEO Knowledge Hub, DOI 10.60566/az1e1-5yr98)	Assessed against. SCiO completes the GEO-LDN Toolbox software self-assessment against these minimum technical, interoperability and content standards, and publishes the documentation, metadata, licence and privacy material the assessment requires.
UNCCD Scientific Conceptual Framework for Land Degradation Neutrality (Orr et al., 2017)	Follows. The neutrality balance is assessed like for like across comparable land types, and the planning workflow is organised around the avoid–reduce–reverse response hierarchy.
Open data transfer formats	Conforms. All raster inputs and outputs are GeoTIFF; all vector inputs are GeoJSON. Tabular exports in CSV and JSON are on the roadmap (Section 15).
Open source licensing	Conforms. The application is published under GPL-3.0, a copyleft licence, in public repositories under github.com/SCiO-systems .

Annex C — Version history

C.1 The tool

Version	Date	What changed
v1.0	28 March 2022	Official launch, following the Tunisia and Burkina Faso pilots.
v1.1	9 May 2022	Incorporated further team feedback ahead of the tool's presentation at UNCCD COP15 (Abidjan, Côte d'Ivoire). This is the version currently deployed at app.landusetool.org .

NOTE

Release tags and notes are published in the repositories at github.com/SCiO-systems/lup4ldn. Planned work is in Section 15.

C.2 This guide

Version	Date	What changed
1.0	August 2026	First consolidated user guide covering the full workflow, drawn from the Tunisia and Burkina Faso piloting material. Internal circulation.
2.0	August 2026	First public release. Re-licensed under CC BY 4.0. Added: the assumptions log (1.3); licence, source code and citation (1.5); the architecture diagram (1.6); privacy and personal data (13); support, feedback and contributing (14); the development roadmap (15); Annex A dataset and output metadata; Annex B standards conformance; Annex C version history; Annex D translation instructions.

Annex D — Translating this guide

This guide is published under **Creative Commons Attribution 4.0 International (CC BY 4.0)**. You may translate it into any language, including the other official languages of the United Nations, and publish your translation — provided you credit the original.

D.1 What you may do

- Translate the whole guide or any part of it.
- Adapt the examples to your national context, datasets and institutions.
- Publish the translation, including in print, and including commercially.

D.2 What you must do

- Credit the original: “Based on the LUP4LDN User Guide v2.0 by SCiO P.C., licensed under CC BY 4.0.”
- Link to the licence: <https://creativecommons.org/licenses/by/4.0/>
- State that changes were made, and identify the translator, so that readers know who to ask about the translation.

D.3 How to go about it

- 01** Write to lup4ldn@scio.systems before you start. SCiO will give you the editable source of the current version and tell you whether a translation into that language is already under way.
- 02** Translate the body text, the tables and the callouts. Leave the literal interface labels — button and menu names — in English, in bold, as they appear in the tool, and put your translation in brackets after the first occurrence.
- 03** Keep the section numbering identical to the English version, so that the two can be cross-referenced in a workshop where both are in use.
- 04** Record the guide version you translated from, in the metadata table on the cover.
- 05** Send SCiO a link to the published translation. It will be listed alongside the English version so that other planning teams can find it.

TIP

French is the highest priority: LUP4LDN's demonstrated user base includes Tunisia, Burkina Faso and Senegal. If you are considering a French translation, say so — SCiO will prioritise support for it.