Long-Term Ecological Monitoring
Final Report

Ministry of Environment, Forest and Climate Change

Himachal Pradesh
Forest Department

german cooperation
DEUTSCHE ZUSAMMENARBEIT

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Address
A-2/18, Safdarjung Enclave,
New Delhi- 110029, India
T +91 11 4949 5353

E biodiv.india@giz.de
W www.indo-germanbiodiversity.com
I www.giz.de

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Conservation and Sustainable Use of Biodiversity in India - Himachal Pradesh Forest Ecosystem Services Project (HP-FES)
The project aims to enable the Forest Department of Himachal Pradesh to introduce the Forest Ecosystem Services (FES) approach in the state's forest management system.
HP-FES

Responsible:
Ravindra Singh, Director
Indo-German Biodiversity Programme, GIZ

Dr. Joachim Schmerbeck, Team leader
HP-FES Project

Authors:
Ralf Ludwig
Rev. by: Ulrich Flender – DFS Deutsche Forstservice GmbH

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ABBREVIATIONS

CTA	Chief Technical Advisor
CV	Curriculum Vitae
CV%	Coefficient of Variation
DB	Database
DBH	Diameter at Breast height
DFS	Deutsche Forstservice GmbH
Doc(x)	Microsoft Word Format ©
E%	Allowable Error
FES	Forest Ecosystem Services
FSI	Forest Survey India
GIS	Geographical Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GPS	Global Positioning System
HFRI	Himalaya Forest Research Institute
HP	Himachal Pradesh
HPFD	Himachal Pradesh Forest Department
HP-FES	Himachal Pradesh Forest Ecosystem Services (Project)
HQ	Head Quarters
IKE	International short-term expert
LTEM	Long Term Ecological Monitoring
M&E	Monitoring and Evaluation
NFI	National Forest Inventory
PM	Person Month
PPT	Microsoft PowerPoint Format ©
SP	Sample Plot, Sample Point, Sample Cluster
TL	Team Leader
TOR	Terms of Reference
Xsl(x)	Microsoft Excel Format ©

CONTACT

DFS Deutsche Forstservice GmbH
Ulrich Flender
Wittelsbacherstr. 11
D - 85622 Feldkirchen, Germany

Tel.: + 49 - 89 - 94 00 59 15
Fax: + 49 - 89 - 94 00 59 79
Email: ulrich.flender@dfs-online.de
URL: www.dfs-online.de

1. STATUS QUO OF IMPLEMENTATION, CHALLENGES AND RISKS

1.1 Amendment of consulting contract

A third amendment became necessary since the delivery of the 3rd Interim Report due to the unclear availability of HPFD staff for a final mission of the CTA and was concluded on 6 April 2020. The term of contract was extended until 31.12.2020. Therefore, this final report as well as the overall consulting input is delivered in due time.

Outlook:

With this final report, the consulting contract to support the development of a LTEM system in HP is successfully closed. The report is accompanied by the delivery of a final invoice.

A final mission to the Project, foreseen for the second half of April 2020, could not be implemented, due to a travel ban to India and related risks through the SARS-CoV2 pandemic. However, the consultant was able to deliver his input via video conferences, Skype and E-mail, including trainings on the LTEM database use.

1.2 Deliverables / reporting duties

Until 14 October 2020, following deliverables and reports have been delivered:

- the Inception Report in the form of a mission report by Ralf Ludwig (as Mission Report, May to June 2018, 16.06.2018), including scope for LTEM in HP, workshop outcome and drafted LTEM framework.
- in addition, presentations have been prepared and delivered for the workshop, workshop outcome and for the major aspects of the LTEM framework.
- 1st Interim Report (Ulrich Flender, 13.05.2019).
- The LTEM framework / concept (Ralf Ludwig, 18.09.2018). Updated by Ulrich Flender (May 05 and September 2019), including the proposed tools for assessment.
- LTEM field manual (Ralf Ludwig, 17.09.2018), including the proposed tools for assessment and field record sheets. Updated by Ulrich Flender based on changes made in the LTEM concept and based on field testing (September 2019 and February 2020), including the proposed tools for assessment.
- A first draft of the graphic user interface / database has been developed by Ralf Ludwig (September 2018). A second draft based on MySQL developed by the Vincent Barrois (DB expert) has been provided during the September 2019 mission of the TL (02.-22.09.2019). A third draft has been provided the February 2020 mission of the TL (08.-23.02.2020).
- Database framework installation guidelines provided to HPFD IT staff for installation on the HPFD server (Vincent Barrois, September 2019).
- Training Modules for LTEM field assessments (Microsoft PowerPoint ©) (Ulrich Flender, September 2019).
- Training Report on LTEM field assessment training, 09th – 13th September 2019, Chail Forest Training Institute, covering in addition the training on LTEM assessment with HPFD GIS Cell staff, which shall take responsibility of the LTEM process (Ulrich Flender, Jyoti Kashyap, September 2019).
- The 2nd Interim Report (Ulrich Flender, September 2019).

- This 3rd Interim Report (Ulrich Flender, February 2020). Including a concept for a final handing over workshop.
- Provision of final LTEM assessment analysis of the first assessment.

  -> Due to lacking field data, this analysis focused on the analysis options to be delivered as implemented in the database based on trial data and was implemented by the CTA and database expert with feedback from GIZ and HPFD staff during the process of developing the LTEM database.

Following progress report is to be delivered, according to adapted deadlines based on actual delays in implementation (see overall LTEM set-up schedule in Table 1):

- Final Report (considering final results of LTEM and concept for final workshop).

  -> Delivery of this Final Report until latest 31.12.2020 (initially as draft version for commenting).

Challenges:

Since all technical reports and inputs were delivered, presented to HPFD and GIZ and comments were considered and integrated, we do not see any challenge for delivering the final document of a final report. However, while the LTEM database is now installed on a specific server in the GIS section of the HPFD, a challenge remains its actual use and maintenance over time.

Risks:

As major risk, we would like to hint to the fact that the database was developed using mainly trial data only, so that smaller programming errors might only show up, once the LTEM database is used for actual assessments in the field. A second risk we see, is that the LTEM Concept and database is finally not put into practice – neither in HP nor in other parts of India, such as through FSI.

1.3 LTEM set up

1.3.1 LTEM concept / framework

The LTEM concept / framework was developed during the first mission of the LTEM consultant to the country of assignment and following home days. It was delivered in a 1st version on 18.09.2018 and updated version on 06.05.2019. A final update on (i) explaining the separation of some of the assessments, (ii) highlighting forest ecosystem services for the assessed variables and (iii) detailing why a combination of a LTEM in HP with the National Forest Inventory is not practicable was delivered before 28.09.2019 for official final approval of HPFD, which can be assumed as given, due to by HPFD accepted and by the consultant provided trainings of field staff and the GIS section of HPFD based on the concept and use of the GUI. Further, HPFD agreed to apply the concept and assess initial 15 SU in Solan Division and provided therefore the required randomly distributed SU.

Challenges:

While the PCCF (externally-aided projects) decided that HPFD has accepted the LTEM concept, so far, the Consultant sees the need to discuss with FSI on how the Project's and FSIs respective approach to LTEM are compatible and therefore to use synergies and avoid overlaps.

Further, there might be the need for clarification on which data shall be later integrated by the LTEM concept, beyond the proposed variables.

Solutions:

The recent LTEM approaches by HPFD (Project) and FSI can hardly be combined: the by FSI proposed LTEM approach comprises 13 one-hectare sample units, that do not allow a statistically acceptable level of selected representative area or entire HP forest area due to the low number of sample units. Therefore, the Project proposed a statistically sound LTEM concept to HPFD, which has been generally accepted by HPFD in May 2019. Still a discussion on the further approach to LTEM is seen necessary, to highlight the advantages of the Project's approach.

Regarding data potentially assessed by the LTEM beyond the planned variables, it is proposed that the foreseen variables, such as forest structure, fire, NTFP, etc. are assessed first, while additional assessments, such as for lichen, mosses, fauna, etc., which require specialists, shall be assessed thereafter. To support the selection process on further assessment variables, GIZ could support HPFD with an additional workshop on discussing the type of these additional assessments, the approach to these assessments (support by specialists) and the timing.

Risks:

Implementation of the LTEM Concept is strongly depending on sufficiently trained staff and resources for the field assessment, where later proved insufficient for the initial assessment of 15 SU (3 SU couldn't be assessed due to insufficient time or resources of the field staff).

1.3.2 LTEM field manual

A final draft of the LTEM field manual has been delivered in September 2019 based on training and field testing during that training.

Challenges and risks: see under 1.3.1 'LTEM concept / framework'.

1.3.3 Area assessed by LTEM

The implementation of the LTEM concept stipulated a decision on the actual LTEM assessment area. The consultant met during the September 2019 mission with HPFD and agreed on piloting the LTEM concept in Solan Division, by randomly selecting 60 sample units within the forest cover map produced by FSI (2017) and assessing at least 15 SU randomly selected among the 60 SU.

This would allow to

i. Pilot the actual LTEM Concept;

ii. Pilot the actual LTEM database and graphic user interface, and

iii. Calculate the variation among the 15 SU and derive a coefficient of variation (CV%), based on which HPFD can decide the number of sample units, when upscaling the LTEM to the entire HP forests area.

Challenges:

Before the random (or by NFI grid) selection of the SU location, following was recommended to be ensured:

i. Ensuring that only forest owned by the state is included in the assessments due to not being permitted to assess in forests owned by others, such as private owners (or ensure that assessments can be done in all ownerships);

ii. previous exclusion of sloped forest sites of > 60 degrees for not being accessible;

iii. previous exclusion of non-forest areas, as well as water bodies (aligned to the approach used for the India State of Forest Report, 2017, referring to forest cover map and tables, p. 198);

iv. National Parks, sanctuaries, biosphere reserves and common reserves will be excluded;

v. Undemarcated Protected Forests (UPF) will be excluded;

vi. Demarcated Protected Forests (DPF) and Reserve Forests will be included.

During the assessment of the 15 SU, actually all approached SU where falling in privat land or were not assessed due to lack of available time of the field staff and (i) hindering a thorough piloting of the LTEM Concept as well as (ii) making it impossible for the consultant to deliver initial assessment results for Solan Division.

Risks:

Ownership: since there is no reliable / official data on forest ownership with the HPFD yet (under progress), selected SU will fall in forest not owned by the state and field assessment teams are not permitted to assess these SU. This leads to less assessed SU (in the piloting no SU data at all), a resulting higher sample error and overall results being less representative or in the worst case unusable.

Solutions:

To test the database within the consultant's contract time, the time is insufficient for assessments. For later initial and follow up assessments it is recommended (until ownership information is available):

i. HPFD shall ensure that other ownerships are included in the sample and are permitted to be assessed as well, due to their importance to the overall provision of FES in HP.

ii. Alternatively, once available, integrate ownership boundaries and select SU only in areas covered by state forests.

iii. For the case forest ownership boundaries are not available, increase in future the number of SU to be selected by the (approximate) ratio of forests under other ownership than state forests. Example: if the share of state-owned forests in HP is 66%, increase the selected number of SU by 34% (previously selected 100 SU would then result in a SU number of 134). This approach would ensure sufficient SU and sufficient representativeness of the selected sample.

1.3.4 LTEM assessment map(s) and list of coordinates

For the selected pilot site of Solan Division, the GIS section / lab of the HPFD, Dr Pushpendra Rana (Project contact person and head of the GIS lab) had the sample grid and map produced based on decisions made in discussions with the consultant (see chapter 1.3.3)

Challenges:

The prepared map for the pilot assessment area includes private forests and probably other ownership.

Risks and solutions:

See under previous chapter 1.3.3.

1.3.5 Assessment tools for training and field implementation

GIZ HQ procured 4 sets of assessment tools for the training of trainers / field teams before the field training in September 2019.

Challenges:

Several tools, such as the ranging rods or callipers were of minor qualities and DBH measure tapes were not available.

Risks:

The assessment error by field teams increases with low quality equipment.

Solutions:

Weaknesses have been discussed with the Project and replacement for the ranging rods and 1 calliper, as well as purchase of 4 diameter tapes foreseen.

1.3.6 Training

The training of field teams (18 participants) was held successfully from 09th – 13th September 2019 and respective training modules and a training schedule have been prepared. Please refer to the specific training report (September 2019) for details and detailed evaluations by the participants.

Challenges & Risks:

Besides the field teams, also staff from the Forest Training Institute Chail as well as from the HPFD GIS cell were invited as future master trainers and monitorer of the field teams respectively, but finally did not participate in the training.

Solutions:

The quality control must be enforced strictly, ideally by a specific QC team. Therefore, 24 participants at GIS cell were trained in September 2019 in a 1-day ad-hoc training on LTEM assessments and the draft LTEM database was presented.

1.3.7 LTEM database and graphic user interface

A 3rd final draft of the database was developed by the DB / GIS expert Vincent Barrois and LTEM expert Ulrich Flender by February 2020 using MySQL, enabling the database to be used online for data entry, analysis, etc. This final draft version contains the entry masks and respective fail saves, an option to provide different user rights (administrator, team leaders, etc.), the full tree species list as used in the NFI (partly improved and extended by criteria such as IUCN status, family, genera, etc.), including local names and codes, analysis of all assessed data, including data tables, charts, maps and statistics as well as a comparison option for separate assessments, assessment statistics (also for compared assessment), diverse filter and grouping options for the results, an import function for a SU set via kml or Geojson format and a backup option. Further, the online interface can be used to enter the data directly into the database (e.g. mobile phone or tablet), while assessing in the field, as long as network is available. The database / GUI has been presented to HPFD GIS cell staff head Mr. Pushpendra Rana (14.02.2020) as well as to project TL and other staff on 20.02.2020.

Comments during these meetings were considered for finalizing the database until end of February 2020, particularly regarding statistics when comparing assessments and result presentation.

Challenges:

The task of the consultant was to develop a user-friendly database and graphic user interface, which has been reached according to all involved parties. The DB was developed so that future assessments can make use of the LTEM system. The DB framework was installed on the HPFD servers.

The DB is in addition developed so that it could be used in other provinces of India or on national level. Therefore, discussions should be held with FSI and the responsible ministries.

Risks: -

Solutions:

A handing over workshop is recommended within 2020 to present the LTEM concept and DB and initial evaluation results and discuss the further use and application of the LTEM concept and DB. For how this workshop is organized and held, please refer to chapter 1.6 ‘Concept note for final LTEM workshop’.

1.4 Field assessments, data processing, quality control

The field assessments were foreseen to start from mid to end of September 2019 and to be finalized until latest end of November 2019. 2 complete field teams consisting of LTEM-assessment-trained forest guards from the pilot area of Solan Division were planned and ready for the field work, provided with the required assessment tools and sample unit locations and instructed on the latest changes of the LTEM approach, manual and forest record sheets. Their respective range officers have been briefed by the consultant and Project and were supportive of the assessments.

Challenges:

While the concept and manual are well accepted for implementation for the first assessment, the actual implementation did not deliver useful results for ecological monitoring of Solan District, due to receiving nearly no results of the assessment of these 15 SU. 10 SU fall in private forests and could not be assessed, while 3 further SU were not approached due to lacking resources / time of the field teams.

Risks:

Due to only having 2 SU assessed during the training of field teams

- There will be no usable initial results, neither for Solan District nor for entire HP;
- The quality control in the field became obsolete, while the quality control of the database entry and database calculation quality became severely hampered and had to work with additional (not in the field assessed) trial data.

Solutions:

There were no initial results provided to HPFD, while the database, including an analysis section, was provided tested on trial data.

It is recommended for HPFD to provide a road map on how and when to implement the LTEM Concept and make use of the provided system including field manual, field record sheets, tools and database.

1.5 Data analysis availability (online)

Once the data has been assessed in the field, it was planned to be enumerated into the specifically designed LTEM database. Lacking any field-assessed data (except 2 SU from the field training), this has not happened.

Challenges:

Lacking ‘real’ field data (i) hinders a thorough piloting of the LTEM Concept as well as (ii) making it impossible for the consultant to deliver initial assessment results for Solan Division and (iii) makes it difficult to quality control the database entry and calculation routines.

Furthermore, LTEM means repeated assessments in time to determine change. Real data could only be provided for an initial but not a follow up assessment.

Risks:

Failure of piloting LTEM Concept in HP.

Solutions:

The consultant worked with the 2 SU assessed during the field training (real data) and added additional trial data to ‘quality control’ the database functionality and plausibility of implemented calculation routines, and provided only exemplary trial analysis results.

Since LTEM means repeated assessments, the consultant provided trial data for additional assessments and enumerated them in the database, to be able to present exemplary graphs,

maps and result tables for changes in between the assessments. This analysis is automatically calculated and presented, as foundation for a detailed analysis.

1.6 Concept note for final LTEM workshop

For the final handover of the LTEM system including database, during the February 2020 mission, a concept note was developed for a workshop to be held likely in April/May 2020, which proved impossible due to the pandemic. It includes information on project and workshop background, workshop objectives, provisional agenda, proposed participants, venue, funding and required workshop documents.

Since no data has been collected for the piloting of the LTEM Concept and database, training and trial data were used to cross-check the quality of results of the system. Data analysis could also take place only in a limited manner, due to not having 2 datasets in time that allow for a trend analysis, the most important aspect for long term monitoring. Therefore, a second trial dataset was provided for piloting.

Thus, while results are not providing a real situation on the ground, the LTEM concept itself and the GUI can be presented and handed over during the workshop based on trial data, including automated analysis functions, exemplary graphs, maps and result tables as foundation for detailed individual analyses and ready to use for LTEM in HP or beyond.

Challenges:

Field assessments with real data would provide the best option for presenting the possibilities of the LTEM concept. These are not available.

Risks:

Calculations within the database are not sufficiently quality controlled due to lacking real field data.

Solutions:

HPFD or Ministry of Environment, Forest and Climate Change, Government of India shall assess the quality of the data, once a roadmap has been decided on how, where and when to implemented the LTEM Concept and once initial real data field assessment has taken place.

2. RECOMMENDATIONS

Final LTEM workshop:

Beyond the presentation and handing over of the LTEM Concept, during the workshop following challenges shall be discussed:

- Decision on where to anchor the provided LTEM system within the Ministry of Environment, Forest and Climate Change, Government of India;
- Decision on where and when to pilot first ‘real’ data assessments, including related costs and financing;
- Identification of synergies with other partners.

LTEM assessments in HP:

It is recommended for HPFD to provide a road map on how and when to implement the LTEM Concept in HP and make use of the provided system including field manual, field record sheets, tools and database.

For implementation it is recommended to set-up a specific LTEM team to coordinate the assessments. Such team should comprise of staff that has been trained on the LTEM concept

(GIS Cell, field staff). The quality control must be enforced strictly, ideally by a specific QC team, being part of the LTEM team.

3. NEXT STEPS - TENTATIVE TIME SCHEDULE FOR LTEM SET UP 2019/2020

A tentative time schedule has been updated during this mission to set-up the LTEM, including activities, each describing potential sub-tasks, required inputs, responsible institution(s), required support and deadlines as well as their completion status (%). Find this time schedule in following Table 1.

Table 1: Tentative Schedule for set-up of LTEM in HP

Tentative Overall Schedule

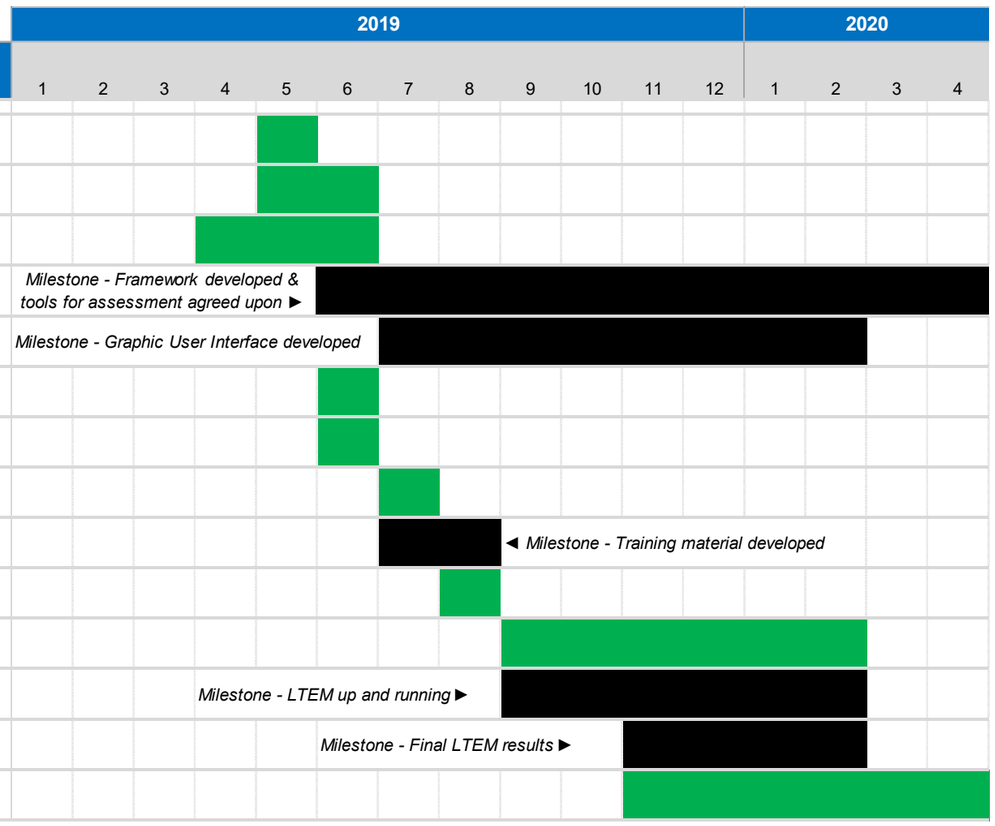
Project: Conservation and Sustainable Use of Biodiversity in India, Forest Ecosystem Services in HP (HP-FES) PN: 11.2210.0-003.00 // VN: 812 227 26

Contract: Set up of a Long Term Ecological Monitoring System

Company DFS Deutsche Forstservice GmbH

Last updated 14.10.2020

TASK DESCRIPTION	PLAN START	DEADLINE	COMPLETE (%)	RESPONSIBLE	SUPPORT
1. Decision on LTEM assessment area	07.05.2019	20.05.2019	100%	HPFD Project mgt.	LTEM consultant
2. Production of LTEM assessment map(s) and list of coordinates	21.05.2019	10.06.2019	100%	HPFD DB/ GIS consultant	LTEM consultant
3. Procurement of assessment tools for training	01.04.2019	30.06.2019	100%	Project mgt.	LTEM consultant
4. Development of LTEM concept & field manual	01.06.2019	28.09.2019	100%	LTEM consultant	HPFD Project mgt.
5. Development of LTEM database / GUI	01.07.2019	29.02.2020	100%	DB / GIS consultant HPFD	LTEM consultant
6. Selection of trainees for training session	10.06.2019	20.06.2019	100%	HPFD Project mgt.	LTEM consultant
7. Selection of field team staff	10.06.2019	20.06.2019	100%	HPFD Project mgt.	LTEM consultant
8. Procurement of assessment tools for field implementation	01.07.2019	31.07.2019	100%	HPFD	LTEM consultant
9. Training materials developed	25.07.2019	08.08.2019	100%	LTEM consultant HPFD, Project mgt	-
10. Training of field teams	20.08.2019	31.08.2019	100%	HPFD	LTEM consultant
11. ~~Implementation of field assessments and~~ Trial data processing	15.09.2019	15.02.2020	100%	HPFD Field teams	LTEM consultant
12. Quality control (QC) of ~~field assessments and~~ data processing	15.09.2019	20.02.2020	100%	HPFD, LTEM / DB / GIS consultant	-
13. Trial data analysis available (online)	16.11.2019	29.02.2020	100%	HPFD, LTEM / DB / GIS consultant	-
14. Provide concept note for final LTEM workshop	16.11.2019	30.04.2020	100%	HPFD, LTEM consultant	-



In red: changed task description due to lacking field assessment data

4. CONSULTING TASKS AND MISSIONS

The following tables provide the status quo of the consulting input, by individual missions and home input (Table 2) and summarized (Table 3).

4.1 Status quo

Table 2: Individual consultant days provided

			Period			Duration (d/m)	
Name (autom.)	Kat. (fill)	Position (autom.)	from	to	Interruption (days)	days	months
Ralf Ludwig / Ulrich Flender	CTA-A	Chief Technical Advisor - LTEM Expert - Abroad	22.05.2018	16.06.2018	0.0	26.0	0.9
Ralf Ludwig / Ulrich Flender	CTA-H	Chief Technical Advisor LTEM Expert - Home	03.08.2018	28.08.2018	8.0	18.0	0.6
Ralf Ludwig / Ulrich Flender	CTA-H	Chief Technical Advisor LTEM Expert - Home	03.09.2018	24.09.2018	11.0	11.0	0.4
Ralf Ludwig / Ulrich Flender	CTA-H	Chief Technical Advisor LTEM Expert - Home	18.02.2019	19.02.2019	0.0	2.0	0.1
Ralf Ludwig / Ulrich Flender	CTA-H	Chief Technical Advisor LTEM Expert - Home	06.03.2019	06.03.2019	0.0	1.0	0.0
Ralf Ludwig / Ulrich Flender	CTA-H	Chief Technical Advisor LTEM Expert - Home	01.04.2019	03.04.2019	0.0	3.0	0.1
Ralf Ludwig / Ulrich Flender	CTA-A	Chief Technical Advisor - LTEM Expert - Abroad	04.05.2019	10.05.2019	0.0	7.0	0.2
Ralf Ludwig / Ulrich Flender	CTA-H	Chief Technical Advisor LTEM Expert - Home	23.07.2019	23.07.2019	0.0	1.0	0.0
Ralf Ludwig / Ulrich Flender	CTA-H	Chief Technical Advisor LTEM Expert - Home	29.07.2019	29.07.2019	0.0	1.0	0.0
Ralf Ludwig / Ulrich Flender	CTA-H	Chief Technical Advisor LTEM Expert - Home	01.08.2019	01.08.2019	0.0	1.0	0.0
Ralf Ludwig / Ulrich Flender	CTA-H	Chief Technical Advisor LTEM Expert - Home	23.08.2019	31.08.2019	2.0	7.0	0.2
Ralf Ludwig / Ulrich Flender	CTA-A	Chief Technical Advisor - LTEM Expert - Abroad	02.09.2019	22.09.2019	0.0	21.0	0.7
Martin Schweter / Vincent Barrois	iKE1-A	GIS/RS & DB Expert - Abroad	02.09.2019	18.09.2019	2.0	15.0	0.5
Ralf Ludwig / Ulrich Flender	CTA-H	Chief Technical Advisor LTEM Expert - Home	01.10.2019	08.10.2019	5.0	3.0	0.1
Martin Schweter / Vincent Barrois	iKE1-A	GIS/RS & DB Expert - Abroad	11.11.2019	29.11.2019	5.0	14.0	0.5
Martin Schweter / Vincent Barrois	iKE1-A	GIS/RS & DB Expert - Abroad	02.12.2019	06.12.2019	0.0	5.0	0.2
Ralf Ludwig / Ulrich Flender	CTA-H	Chief Technical Advisor LTEM Expert - Home	03.12.2019	06.12.2019	0.0	4.0	0.1
Ralf Ludwig / Ulrich Flender	CTA-A	Chief Technical Advisor - LTEM Expert - Abroad	07.01.2020	15.01.2020	2.0	7.0	0.2
Martin Schweter / Vincent Barrois	iKE1-A	GIS/RS & DB Expert - Abroad	07.01.2020	14.01.2020	2.0	6.0	0.2
Martin Schweter / Vincent Barrois	iKE1-H	GIS/RS & DB Expert - Home	14.01.2020	31.01.2020	5.0	13.0	0.4
Martin Schweter / Vincent Barrois	iKE1-H	GIS/RS & DB Expert - Home	03.02.2020	20.02.2020	2.0	16.0	0.5
Ralf Ludwig / Ulrich Flender	CTA-A	Chief Technical Advisor - LTEM Expert - Abroad	08.02.2020	23.02.2020	0.0	16.0	0.5
Ralf Ludwig / Ulrich Flender	CTA-A	Chief Technical Advisor - LTEM Expert - Abroad	26.02.2020	26.02.2020	0.0	1.0	0.0
Ralf Ludwig / Ulrich Flender	CTA-A	Chief Technical Advisor - LTEM Expert - Abroad	26.03.2020	28.03.2020	0.0	3.0	0.1
Ralf Ludwig / Ulrich Flender	CTA-A	Chief Technical Advisor - LTEM Expert - Abroad	14.04.2020	20.04.2020	4.0	3.0	0.1
Ralf Ludwig / Ulrich Flender	CTA-A	Chief Technical Advisor - LTEM Expert - Abroad	07.05.2020	12.05.2020	2.0	4.0	0.1
Ralf Ludwig / Ulrich Flender	CTA-A	Chief Technical Advisor - LTEM Expert - Abroad	04.08.2020	21.08.2020	14.0	4.0	0.1
Martin Schweter / Vincent Barrois	iKE1-H	GIS/RS & DB Expert - Home	13.08.2020	27.08.2020	4.0	11.0	0.4
Ralf Ludwig / Ulrich Flender	CTA-A	Chief Technical Advisor - LTEM Expert - Abroad	04.09.2020	08.09.2020	1.0	4.0	0.1

Table 3: Summary – consultant days provided and remaining

				Consulting Input				
Expert	**Position**	**Name**	**Mobilized through**	**Total Contract Provisions (days)**	**Cumulated Effective Services (Days)**	**Cumulated Effective Services (PM) (convert.)**	**Remaining (PM)**	**Remaining (Days)**
CTA-A	*Chief Technical Advisor - LTEM Expert - Abroad*	*Ralf Ludwig / Ulrich Flender*	*DFS*	3.20	96	3.200		
CTA-H	*Chief Technical Advisor LTEM Expert - Home*	*Ralf Ludwig / Ulrich Flender*	*DFS*	1.73	52	1.733		
iKE1-A	*GIS/RS & DB Expert - Abroad*	*Martin Schweter / Vincent Barrois*	*DFS*	1.33	40	1.333		
iKE1-H	*GIS/RS & DB Expert - Home*	*Martin Schweter / Vincent Barrois*	*DFS*	1.33	40	1.333		
TOTAL				**7.60**	**228.00**	**7.60**		

ANNEX

Annex 1:
Impressions from consulting input missions

giz

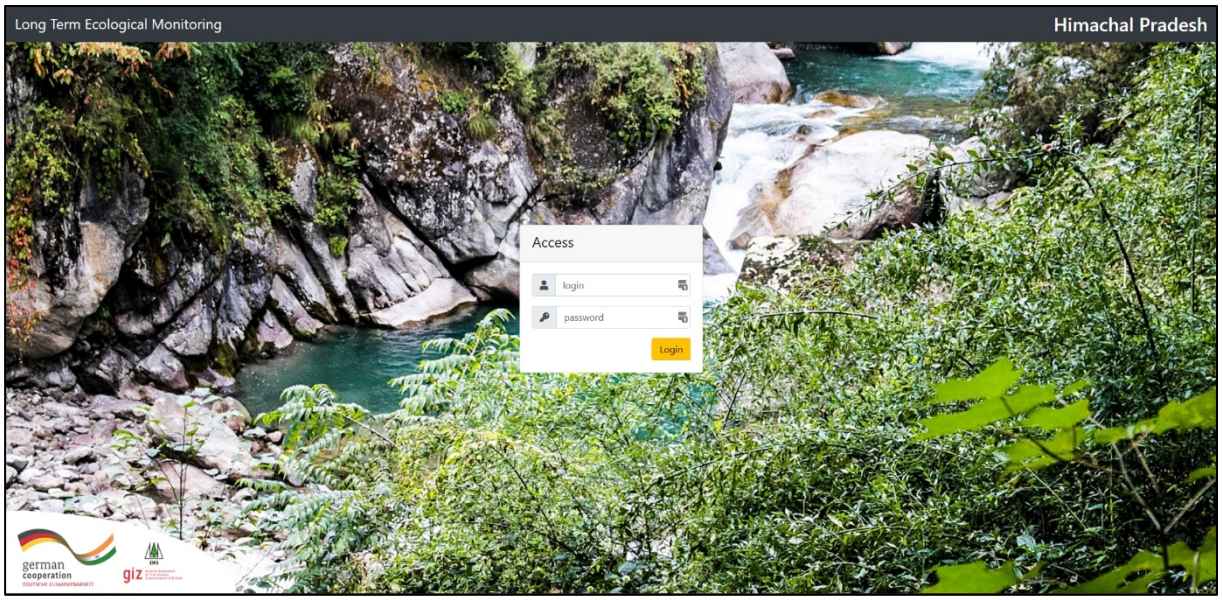
giz
giz

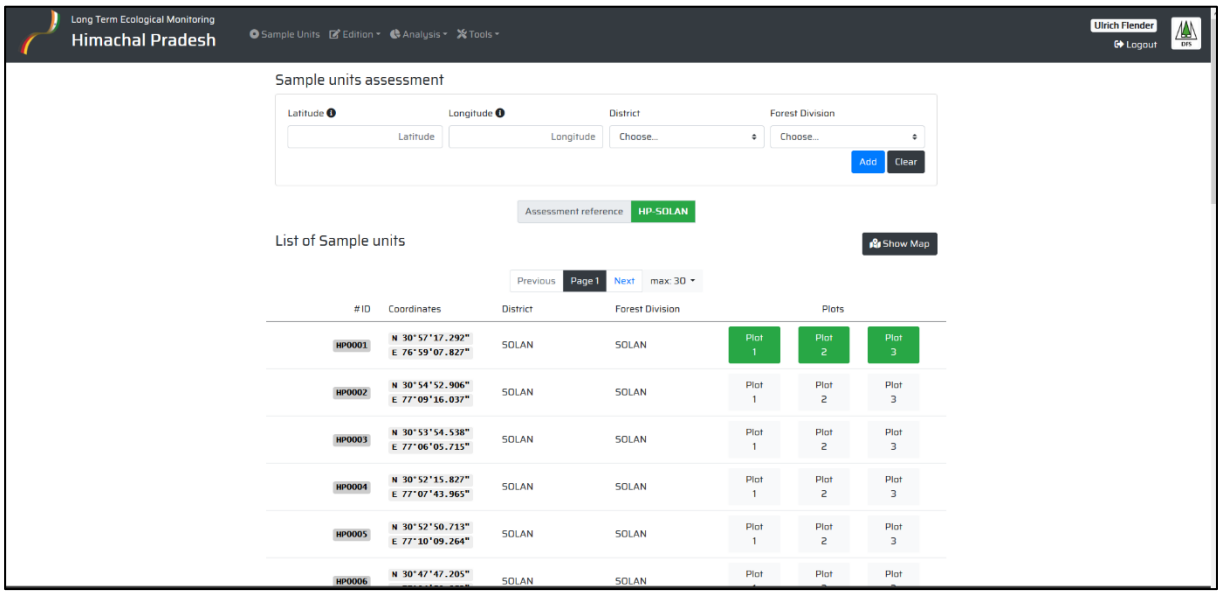
FOLLOW ME

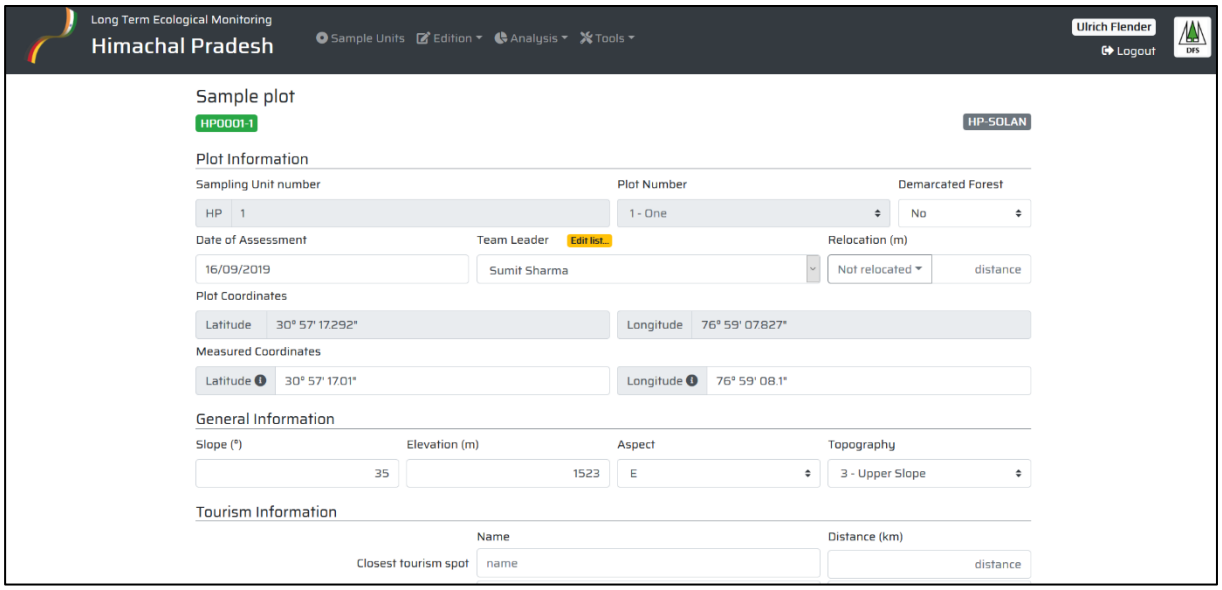
GIZ-LTEM-TR
giz

देवदार सभागा

Annex 2:
Impressions from LTEM Database


Long Term Ecological Monitoring
Himachal Pradesh
Access
login
password
Login
german cooperation
giz

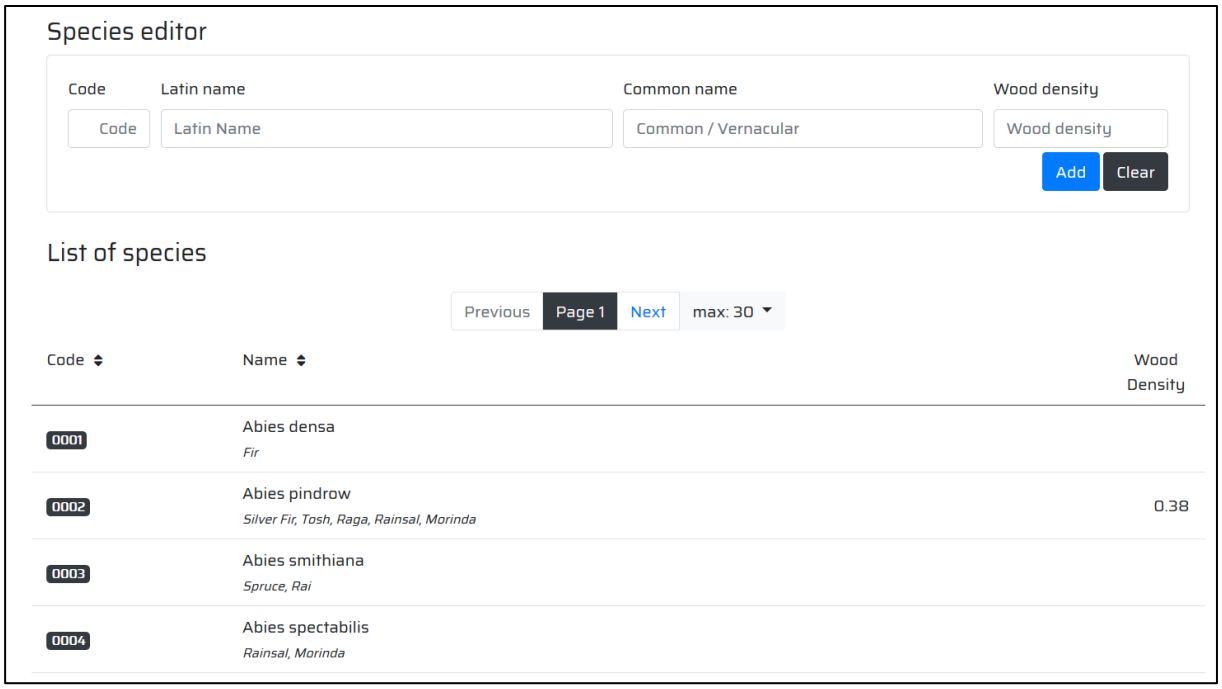

Long Term Ecological Monitoring
Himachal Pradesh
Sample Units
Edition
Analysis
Tools
Ulrich Flender
Logout
Sample units assessment
Latitude
Longitude
District
Forest Division
Choose...
Add
Clear
Assessment reference
HP-SOLAN
List of Sample units
Show Map
Previous
Page 1
Next
max: 30
#ID
Coordinates
District
Forest Division
Plots
HP0001
N 30°57'17.292"
E 76°59'07.827"
SOLAN
SOLAN
Plot 1
Plot 2
Plot 3
HP0002
N 30°54'52.906"
E 77°09'16.037"
HP0003
N 30°53'54.538"
E 77°06'05.715"
HP0004
N 30°52'15.827"
E 77°07'43.965"
HP0005
N 30°52'50.713"
E 77°10'09.264"
HP0006
N 30°47'47.205"

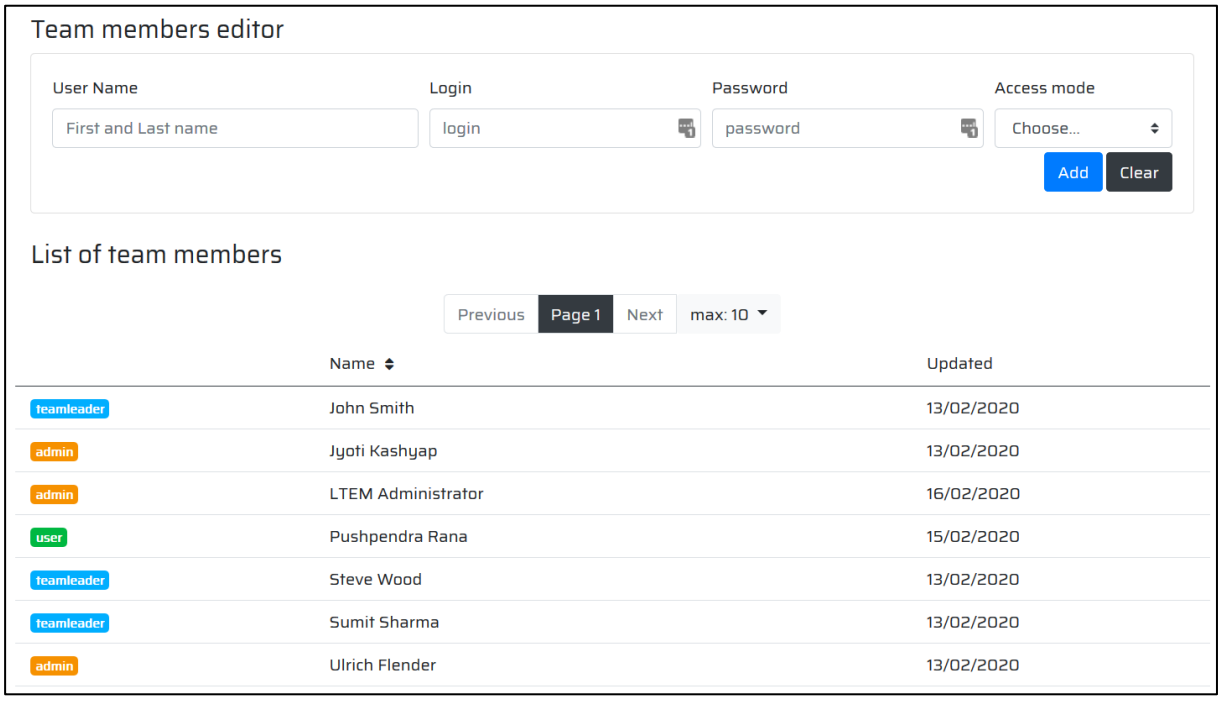


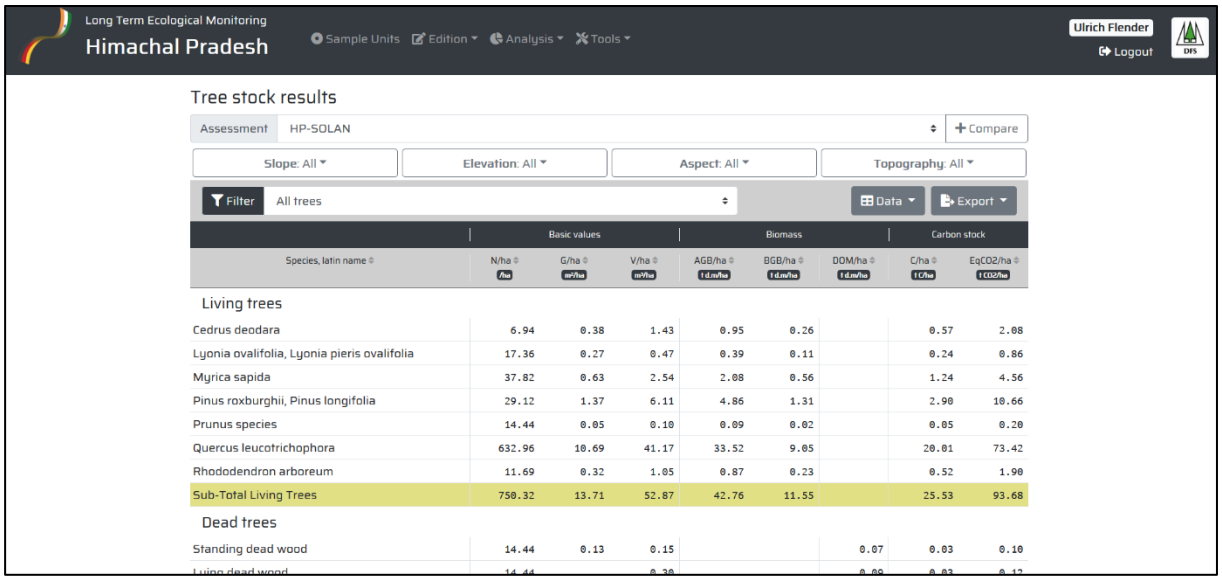
List of trees 10 individuals

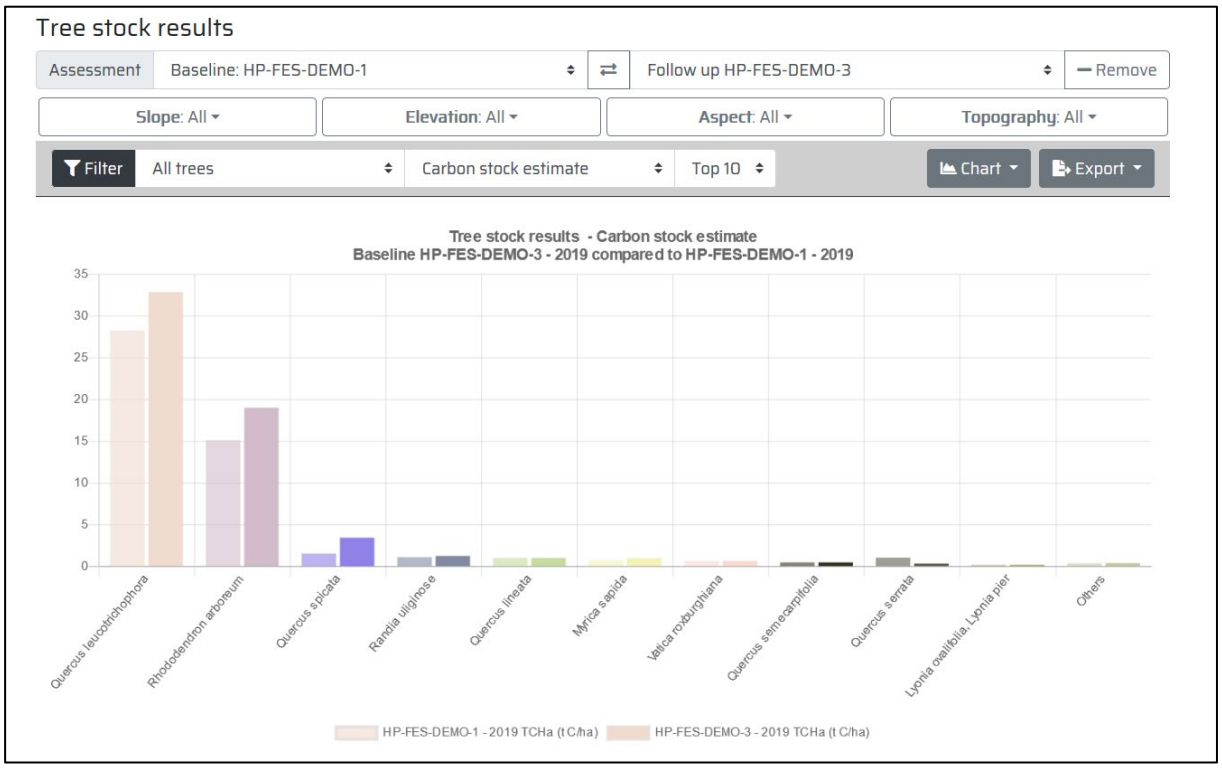
Previous | Page 1 | Next | max: 10

Species Name	Distance (m)	Azimuth (°)	DBH (cm)	Height (m)	Damages	Dead	Decay (%)
Myrica sapida *Kaphal*	4.25	200	5.9	3.9	L F A O	alive	0
Quercus leucotrichophora	5.41	81	8.5	6.1	L F A O	alive	0
Quercus leucotrichophora	5.70	114	6.0	3.7	L F A O	alive	0
Quercus leucotrichophora	3.14	228	6.9	4.2	L F A O	alive	0
Quercus leucotrichophora	5.92	294	14.0	5.6	L F A O	alive	0
Quercus leucotrichophora	6.80	334	6.7	5.4	L F A O	alive	0
Quercus leucotrichophora	3.19	304	7.5	5.9	L F A O	alive	0
Quercus leucotrichophora	6.89	180	10.0	7.0	L F A O	alive	0
Quercus leucotrichophora	4.78	114	9.2	6.5	L F A O	alive	0


Species editor
Code
Latin name
Common name
Wood density
Code
Latin Name
Common / Vernacular
Wood density
Add
Clear
List of species
Previous
Page 1
Next
max: 30
Code
Name
Wood Density
0001
Abies densa
Fir
0002
Abies pindrow
Silver Fir, Tosh, Raga, Rainsal, Morinda
0.38
0003
Abies smithiana
Spruce, Rai
0004
Abies spectabilis
Rainsal, Morinda


Team members editor
User Name
Login
Password
Access mode
First and Last name
login
password
Choose...
Add
Clear
List of team members
Previous
Page 1
Next
max: 10
Name
Updated
teamleader
John Smith
13/02/2020
admin
Jyoti Kashyap
13/02/2020
admin
LTEM Administrator
16/02/2020
user
Pushpendra Rana
15/02/2020
teamleader
Steve Wood
13/02/2020
teamleader
Sumit Sharma
13/02/2020
admin
Ulrich Flender
13/02/2020


Long Term Ecological Monitoring
Himachal Pradesh
Sample Units
Edition
Analysis
Tools
Ulrich Flender
Logout
Tree stock results
Assessment
HP-SOLAN
Compare
Slope: All
Elevation: All
Aspect: All
Topography: All
Filter
All trees
Data
Export
Basic values
Biomass
Carbon stock
Species, latin name
N/ha
G/ha
V/ha
AGB/ha
BGB/ha
DOM/ha
C/ha
EqCO2/ha
Living trees
Cedrus deodara 6.94 0.38 1.43 0.95 0.26 0.57 2.08
Lyonia ovalifolia, Lyonia pieris ovalifolia 17.36 0.27 0.47 0.39 0.11 0.24 0.86
Myrica sapida 37.82 0.63 2.54 2.08 0.56 1.24 4.56
Pinus roxburghii, Pinus longifolia 29.12 1.37 6.11 4.86 1.31 2.90 10.66
Prunus species 14.44 0.05 0.10 0.09 0.02 0.05 0.20
Quercus leucotrichophora 632.96 10.69 41.17 33.52 9.05 20.01 73.42
Rhododendron arboreum 11.69 0.32 1.05 0.87 0.23 0.52 1.90
Sub-Total Living Trees 750.32 13.71 52.87 42.76 11.55 25.53 93.68
Dead trees
Standing dead wood 14.44 0.13 0.15 0.07 0.03 0.10


Tree stock results
Assessment
Baseline: HP-FES-DEMO-1
Follow up HP-FES-DEMO-3
Remove
Slope: All
Elevation: All
Aspect: All
Topography: All
Filter
All trees
Carbon stock estimate
Top 10
Chart
Export
Tree stock results - Carbon stock estimate
Baseline HP-FES-DEMO-3 - 2019 compared to HP-FES-DEMO-1 - 2019
35
30
25
20
15
10
5
0
Quercus leucotrichophora
Rhododendron arboreum
Quercus spicata
Randia uliginose
Quercus lineata
Myrica sapida
Vatica roxburghiana
Quercus semecarpifolia
Quercus serrata
Lyonia ovalifolia, Lyonia pier
Others
HP-FES-DEMO-1 - 2019 TCHa (t C/ha)
HP-FES-DEMO-3 - 2019 TCHa (t C/ha)

Tree stock statistics

Assessment: HP-SOLAN

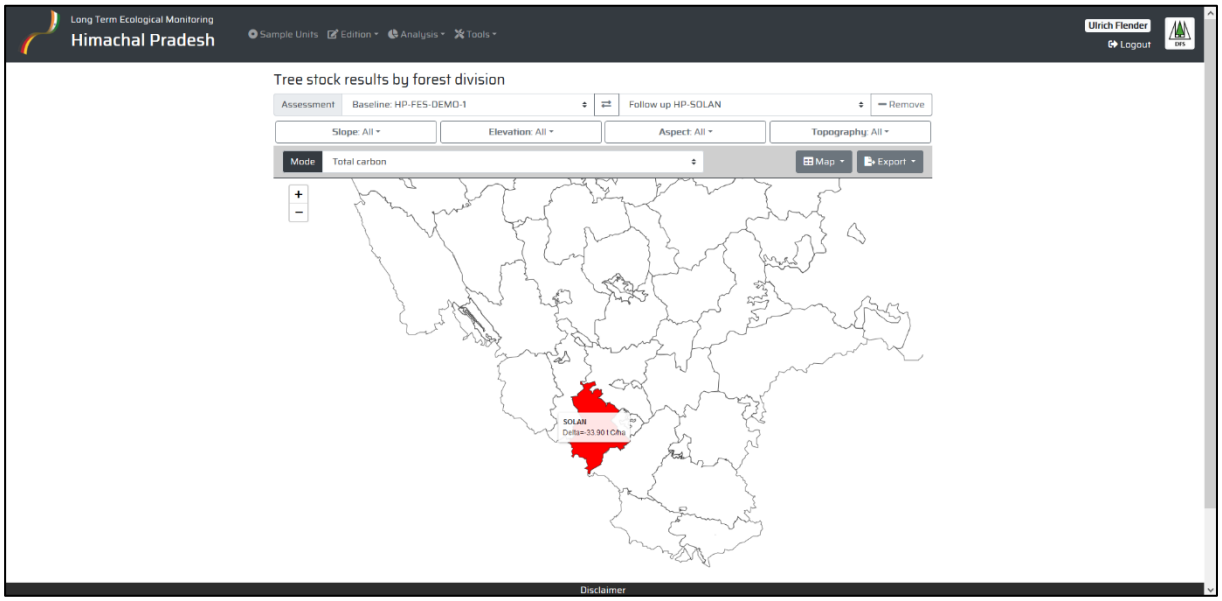
Slope: All | Elevation: All | Aspect: All | Topography: All

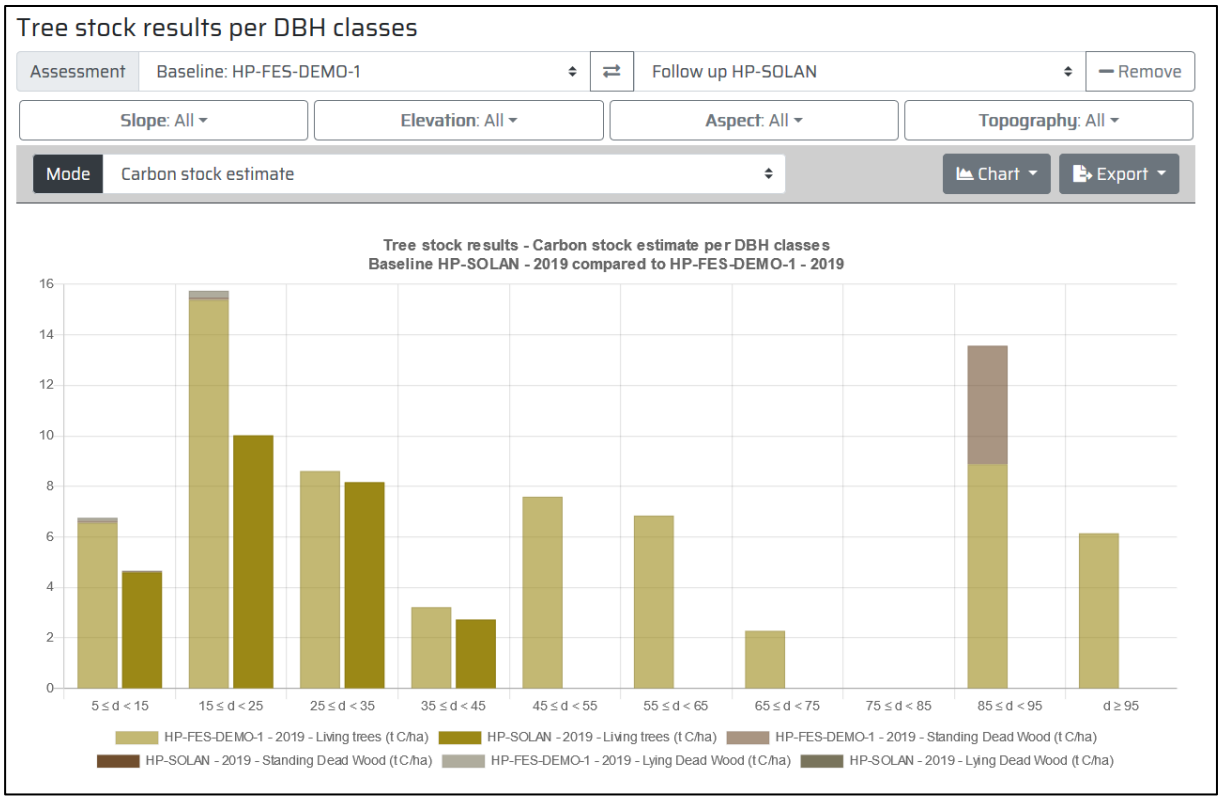
Filter: All trees | Statistics | Export

< previous | next >

Samplint unit N°	N/ha /ha	G/ha m²/ha	V/ha m³/ha	AGB/ha t d.m/ha	BGB/ha t d.m/ha	C/ha t C/ha	EqCO2/ha t CO2/ha	N/ha /ha
	Living Biomass							Standing Dea
Statistics								
Number of units	3	3	3	3	3	3	3	3
Mean	750.32	13.71	52.87	42.76	11.55	25.53	93.68	14.44
Variance	232572.38	41.73	596.97	408.14	29.75	145.42	1958.61	0.00
Standard deviation	482.26	6.46	24.43	20.20	5.45	12.06	44.26	0.00
Coefficient of variation (%)	64.27	47.11	46.21	47.24	47.24	47.24	47.24	0.00
Standard error of the Mean	278.43	3.73	14.11	11.66	3.15	6.96	25.55	0.00
Standard error of the Mean (%)	37.11	27.20	26.68	27.28	27.28	27.28	27.28	0.00
MOE [%] (95% conf. level)	159.64	117.01	114.79	117.34	117.34	117.34	117.34	0.00

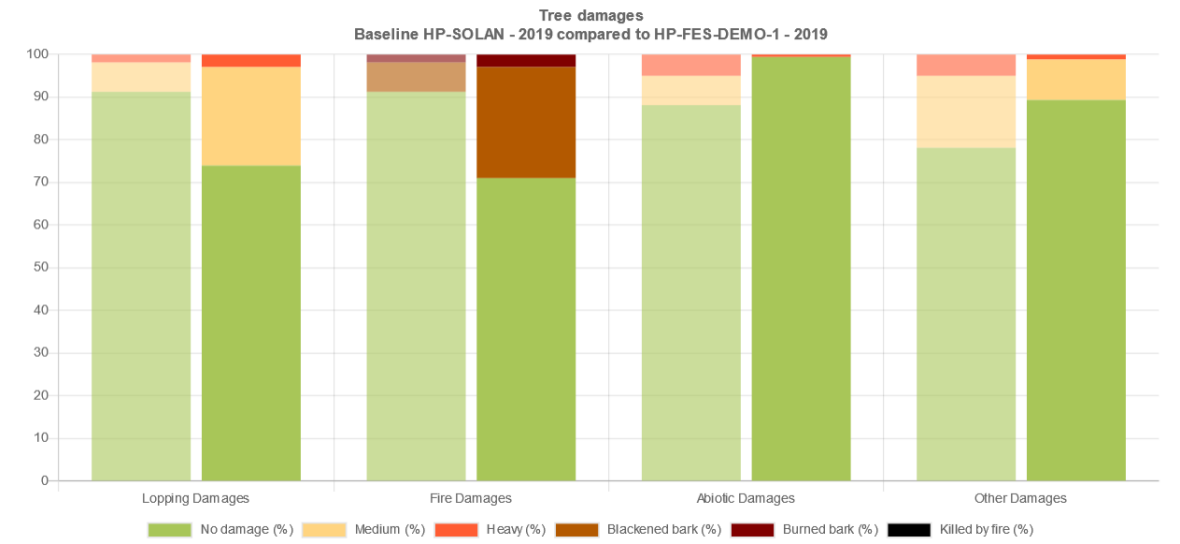
DISCLAIMER:
The Standard Error of the Mean / Margin of Error [%] of sub-selections such as Districts, slope, elevation, aspect or topography sub-groups, etc. is less accurate compared to the Standard Error of the Mean / Margin of Error [%] of the overall sample (due to the respective lower sampling intensity per sub-selection).
Generally, a sub-selection covered by less than 16 sample units is not considered to be statistically reliable. In general, it is the responsibility of the user of this data to interpret it according its statistical indicators for its statistical significance and reliability.
Please refer for actual statistical results to the statistics results.



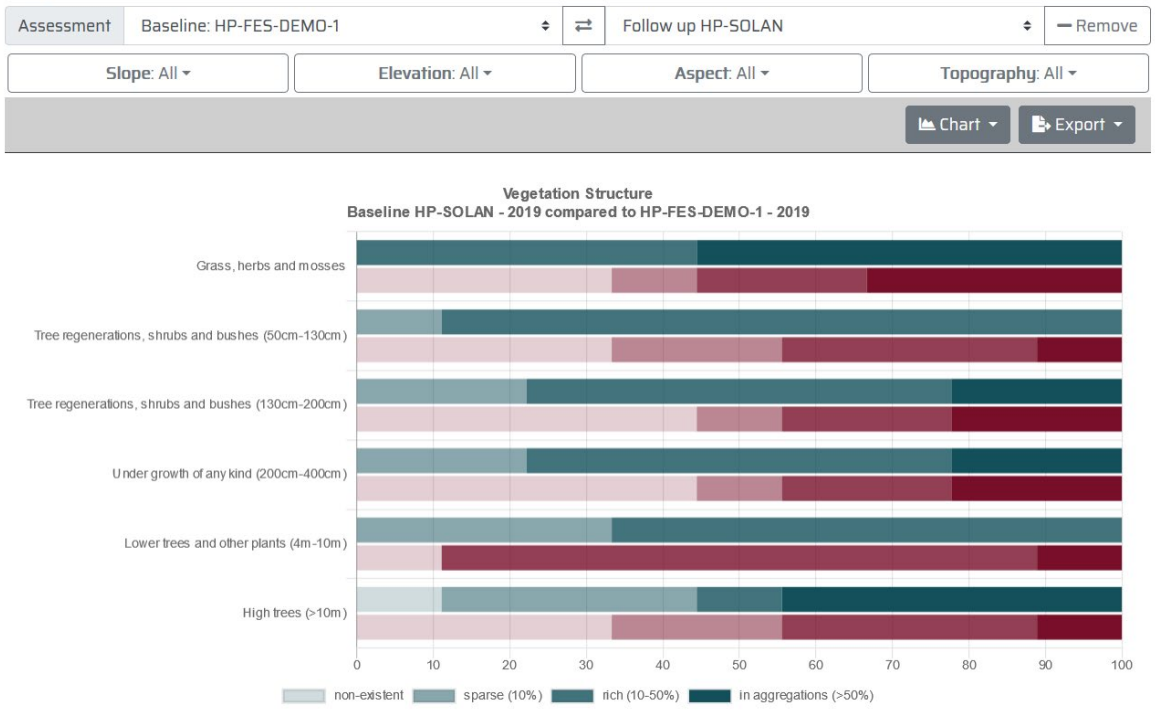

Tree stock results per DBH classes
Assessment
Baseline: HP-FES-DEMO-1
Follow up HP-SOLAN
Remove
Slope: All
Elevation: All
Aspect: All
Topography: All
Mode
Carbon stock estimate
Chart
Export
Tree stock results - Carbon stock estimate per DBH classes
Baseline HP-SOLAN - 2019 compared to HP-FES-DEMO-1 - 2019
16
14
12
10
8
6
4
2
0
5 ≤ d < 15
15 ≤ d < 25
25 ≤ d < 35
35 ≤ d < 45
45 ≤ d < 55
55 ≤ d < 65
65 ≤ d < 75
75 ≤ d < 85
85 ≤ d < 95
d ≥ 95
HP-FES-DEMO-1 - 2019 - Living trees (t C/ha)
HP-SOLAN - 2019 - Living trees (t C/ha)
HP-FES-DEMO-1 - 2019 - Standing Dead Wood (t C/ha)
HP-SOLAN - 2019 - Standing Dead Wood (t C/ha)
HP-FES-DEMO-1 - 2019 - Lying Dead Wood (t C/ha)
HP-SOLAN - 2019 - Lying Dead Wood (t C/ha)

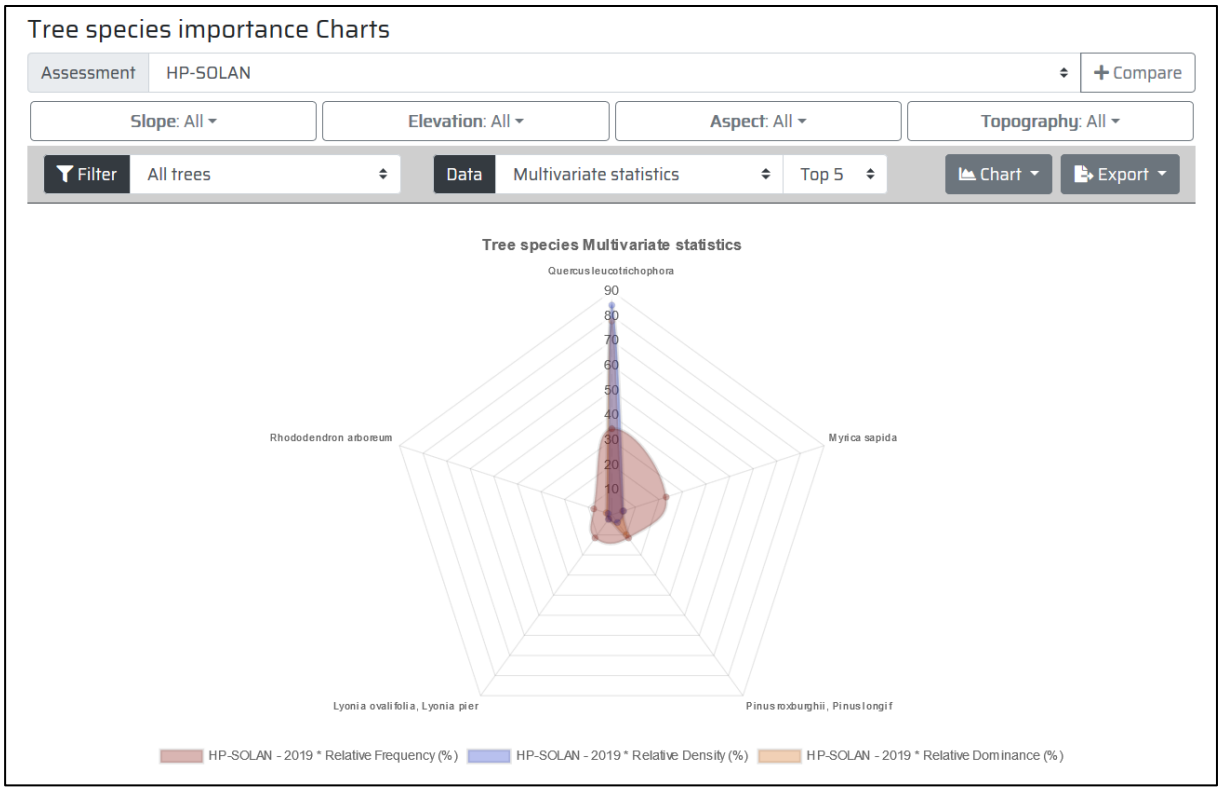
Tree damage classes chart
Assessment
HP-SOLAN
Compare
Slope: All
Elevation: All
Aspect: All
Topography: All
Chart
Export
Tree damages
100
90
80
70
60
50
40
30
20
10
0
Lopping Damages
Fire Damages
Abiotic Damages
Other Damages
No damage (%)
Medium (%)
Heavy (%)
Blackened bark (%)
Burned bark (%)
Killed by fire (%)

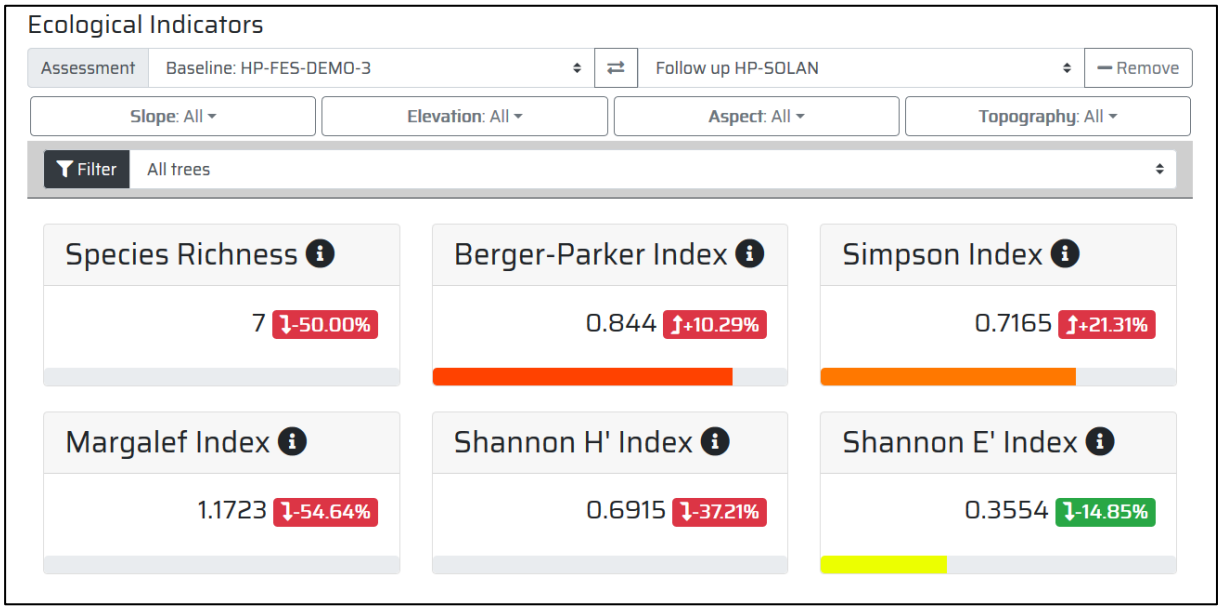
Tree damage classes chart



Vegetation structure chart




Tree species importance Charts
Assessment
HP-SOLAN
Compare
Slope: All
Elevation: All
Aspect: All
Topography: All
Filter
All trees
Data
Multivariate statistics
Top 5
Chart
Export
Tree species Multivariate statistics
Quercus leucotrichophora
90
80
70
60
50
40
30
20
10
Rhododendron arboreum
Myrica sapida
Lyonia ovalifolia, Lyonia pier
Pinus roxburghii, Pinus longif
HP-SOLAN - 2019 * Relative Frequency (%)
HP-SOLAN - 2019 * Relative Density (%)
HP-SOLAN - 2019 * Relative Dominance (%)


Ecological Indicators
Assessment
Baseline: HP-FES-DEMO-3
Follow up HP-SOLAN
Remove
Slope: All
Elevation: All
Aspect: All
Topography: All
Filter
All trees
Species Richness
7 -50.00%
Berger-Parker Index
0.844 +10.29%
Simpson Index
0.7165 +21.31%
Margalef Index
1.1723 -54.64%
Shannon H' Index
0.6915 -37.21%
Shannon E' Index
0.3554 -14.85%

Shrubs and bushes vegetation

Assessment | HP-SOLAN | + Compare

Slope: All | Elevation: All | Aspect: All | Topography: All

Species

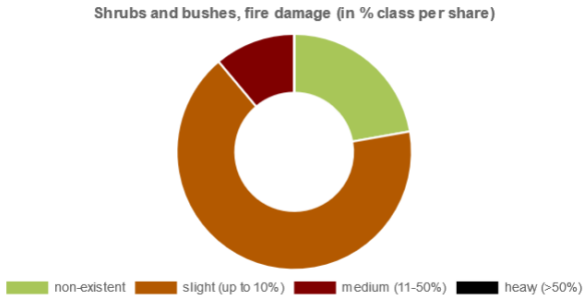
Average number of different species:	6.56
Coverage:	32.22%

Fire damage

non-existent:	22.22%
slight (up to 10%):	66.67%
medium (11-50%):	11.11%
heavy (>50%):	

Fire damage chart

Export chart



Lantana camara species

Number of individuals:	0.00/ha
Coverage:	0.00%

Chromolaena odorata species

Number of individuals:	0.00/ha
Coverage:	0.00%

Grazing intensity

Assessment | HP-SOLAN | + Compare

Slope: All | Elevation: All | Aspect: All | Topography: All

Early grazing

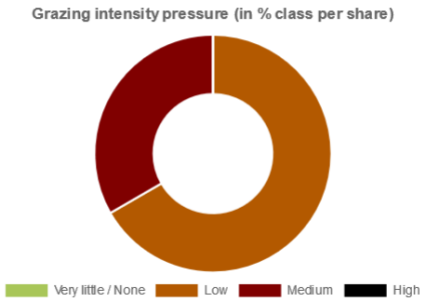
% of area where early grazing is visible:	66.67%

Grazing intensity pressure (% share)

Very little / None	0.00%
Low	66.67%
Medium	33.33%
High	

Grazing intensity pressure chart

Export chart



NTFPs

Assessment | HP-SOLAN | + Compare

Slope: All | Elevation: All | Aspect: All | Topography: All

All products

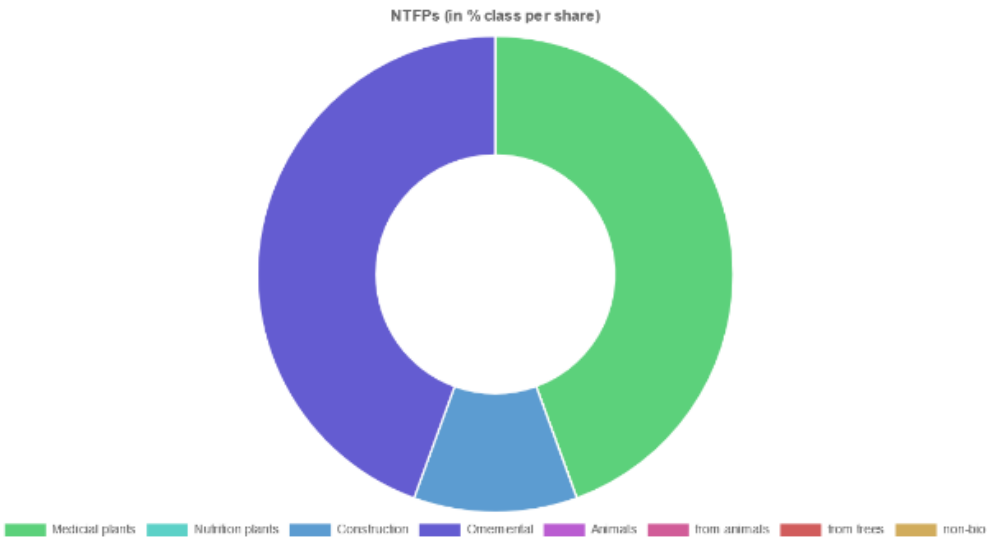
Average No. over all types: 2.00

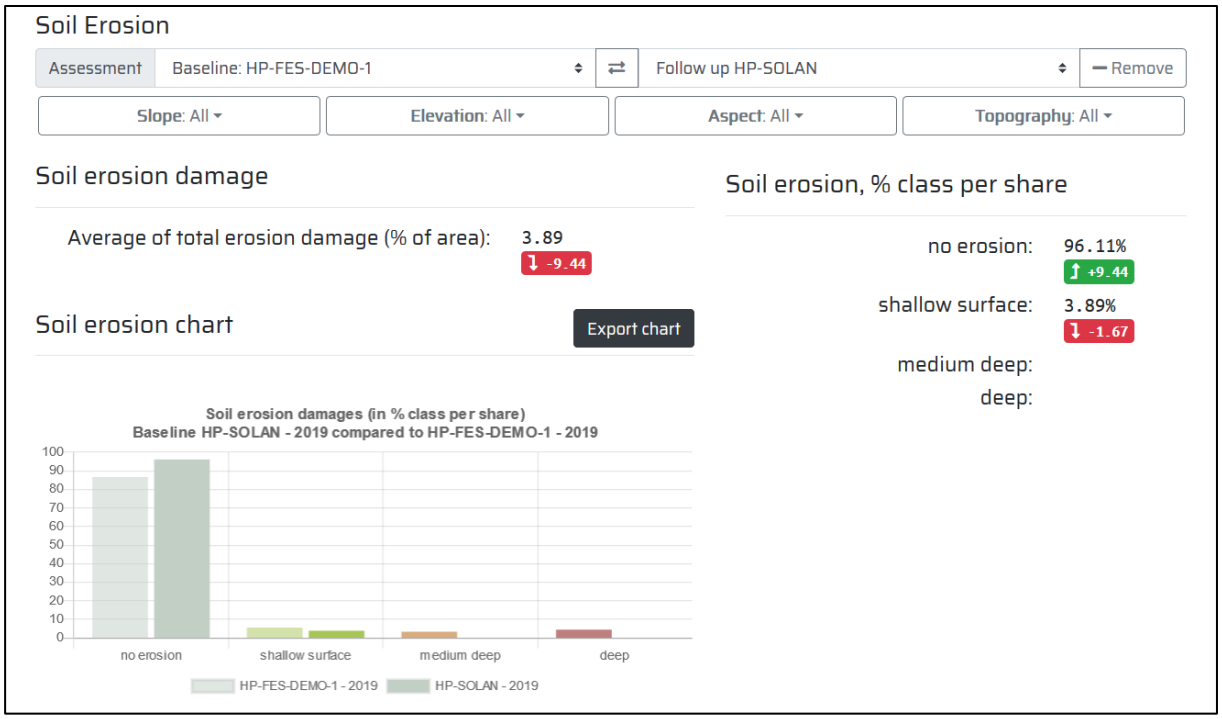
Non-timber forest products per classes

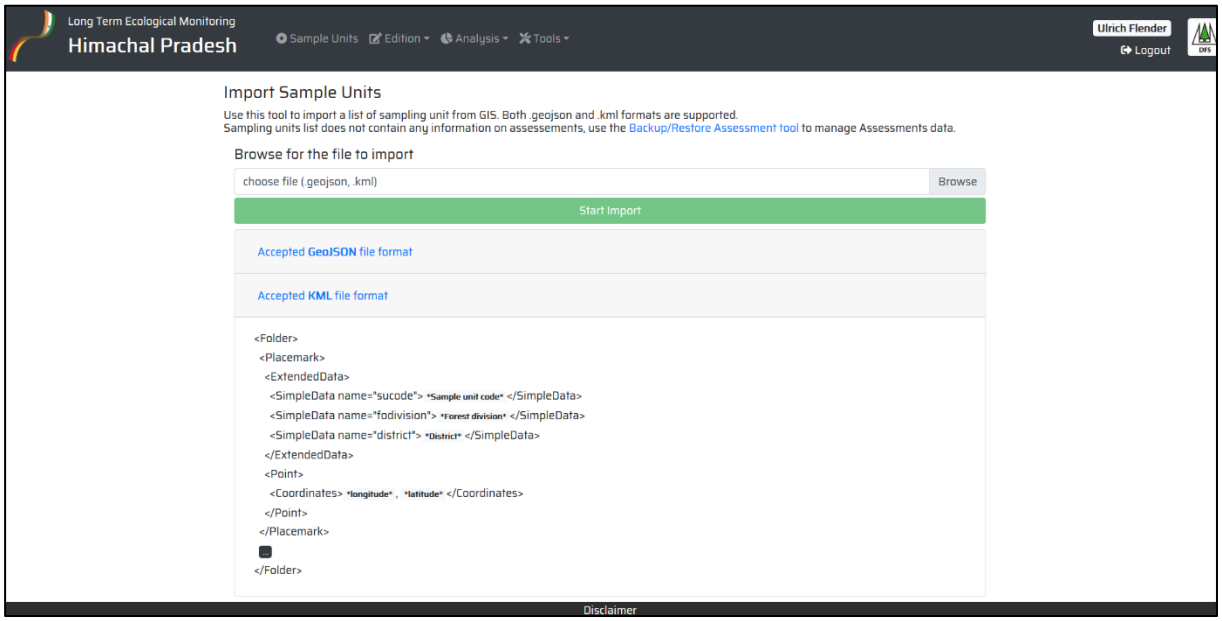
Medicinally used plants and parts of plants:	0.89 (44.44%)
As nutrition or spice used plants:	0.00 (0.00%)
As construction, roofing materials, other than wood:	0.22 (11.11%)
Ornemantal products (flowers, leaf or bark for decoration, etc...):	0.89 (44.44%)
Animals, insects trapped and used for food, spices, medicine:	0.00 (0.00%)
Product collected from animals (such as honey):	0.00 (0.00%)
Product collected from trees other than fruit, seeds (such as resin):	0.00 (0.00%)
Non-bio products collectedin the forest (soil, rocks, ore, etc...):	0.00 (0.00%)

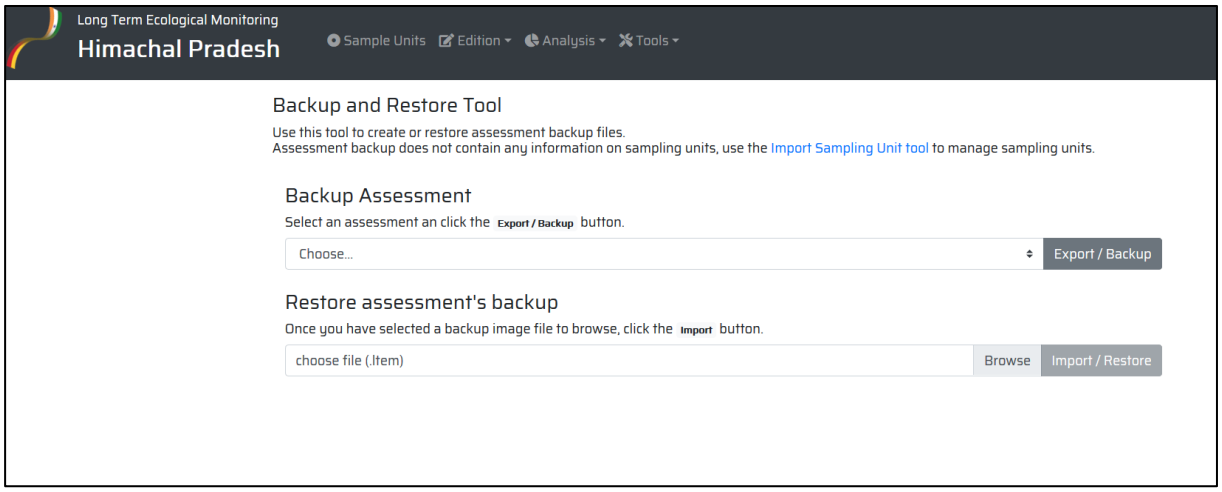
Non-timber forest products (% class per share)

Export chart




Soil Erosion
Assessment
Baseline: HP-FES-DEMO-1
Follow up HP-SOLAN
Remove
Slope: All
Elevation: All
Aspect: All
Topography: All
Soil erosion damage
Average of total erosion damage (% of area):
3.89
-9.44
Soil erosion chart
Export chart
Soil erosion damages (in % class per share)
Baseline HP-SOLAN - 2019 compared to HP-FES-DEMO-1 - 2019
100
90
80
70
60
50
40
30
20
10
0
no erosion
shallow surface
medium deep
deep
HP-FES-DEMO-1 - 2019
HP-SOLAN - 2019
Soil erosion, % class per share
no erosion:
96.11%
+9.44
shallow surface:
3.89%
-1.67
medium deep:
deep:


Long Term Ecological Monitoring
Himachal Pradesh
Sample Units
Edition
Analysis
Tools
Ulrich Flender
Logout
Import Sample Units
Use this tool to import a list of sampling unit from GIS. Both .geojson and .kml formats are supported.
Sampling units list does not contain any information on assessements, use the Backup/Restore Assessment tool to manage Assessments data.
Browse for the file to import
choose file (.geojson, .kml)
Browse
Start Import
Accepted GeoJSON file format
Accepted KML file format
<Folder>
<Placemark>
<ExtendedData>
<SimpleData name="sucode"> *Sample unit code* </SimpleData>
<SimpleData name="fodivision"> *Forest division* </SimpleData>
<SimpleData name="district"> *District* </SimpleData>
</ExtendedData>
<Point>
<Coordinates> *longitude* , *latitude* </Coordinates>
</Point>
</Placemark>
</Folder>
Disclaimer


Long Term Ecological Monitoring
Himachal Pradesh
Sample Units
Edition
Analysis
Tools
Backup and Restore Tool
Use this tool to create or restore assessment backup files.
Assessment backup does not contain any information on sampling units, use the Import Sampling Unit tool to manage sampling units.
Backup Assessment
Select an assessment an click the Export / Backup button.
Choose...
Export / Backup
Restore assessment's backup
Once you have selected a backup image file to browse, click the Import button.
choose file (.Item)
Browse
Import / Restore

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Matsubara Building, Village Sargheen
(Near HFRI), Shimla - 171013
Himachal Pradesh (India)

For further Information
Principal Chief Conservator of Forest, Forest Department,
Himachal Pradesh, Talland, Shimla- 171001, India