



Perencanaan Bentang Lahan Multifungsi Menggunakan LUMENS

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Latar Belakang LUMENS



Membantu mengidentifikasi “apa”, “di mana” dan “siapa” untuk menggunakan lahan secara berkelanjutan

Memperjelas tujuan bersama dalam mencapai target konservasi dan pembangunan lintas sektor



Perencanaan penggunaan lahan?



Mengidentifikasi adanya potensi konflik akibat tumpang tindih dalam unit perencanaan dan zonasi

Mendorong proses inklusif: transparansi, negosiasi, pemahaman melalui pendekatan berbasis hak dan informasi



Tujuan dan Prinsip LUMENS

Untuk memberdayakan proses negosiasi multi-pemangku kepentingan yang inklusif, terpadu, dan terinformasi dalam merencanakan penggunaan lahan untuk lanskap berkelanjutan yang dapat mendukung mata pencaharian dan pembangunan sambil memelihara dan memulihkan layanan lingkungan, terutama di negara-negara tropis.

INCLUSIVE

Keterlibatan semua pihak dalam setiap kegiatan berbasis lahan, terutama pada tahap diagnosis dan eksplorasi pilihan.



INFORMED

Memastikan bahwa keputusan perencanaan terkait lahan dibuat berdasarkan pengetahuan yang berasal dari data, informasi, dan pemahaman proses dan fungsi yang kontekstual.



INTEGRATIVE

Mendorong proses yang sinergis dan tujuan yang selaras antara konservasi, pembangunan, dan perencanaan tata guna lahan





Lumens

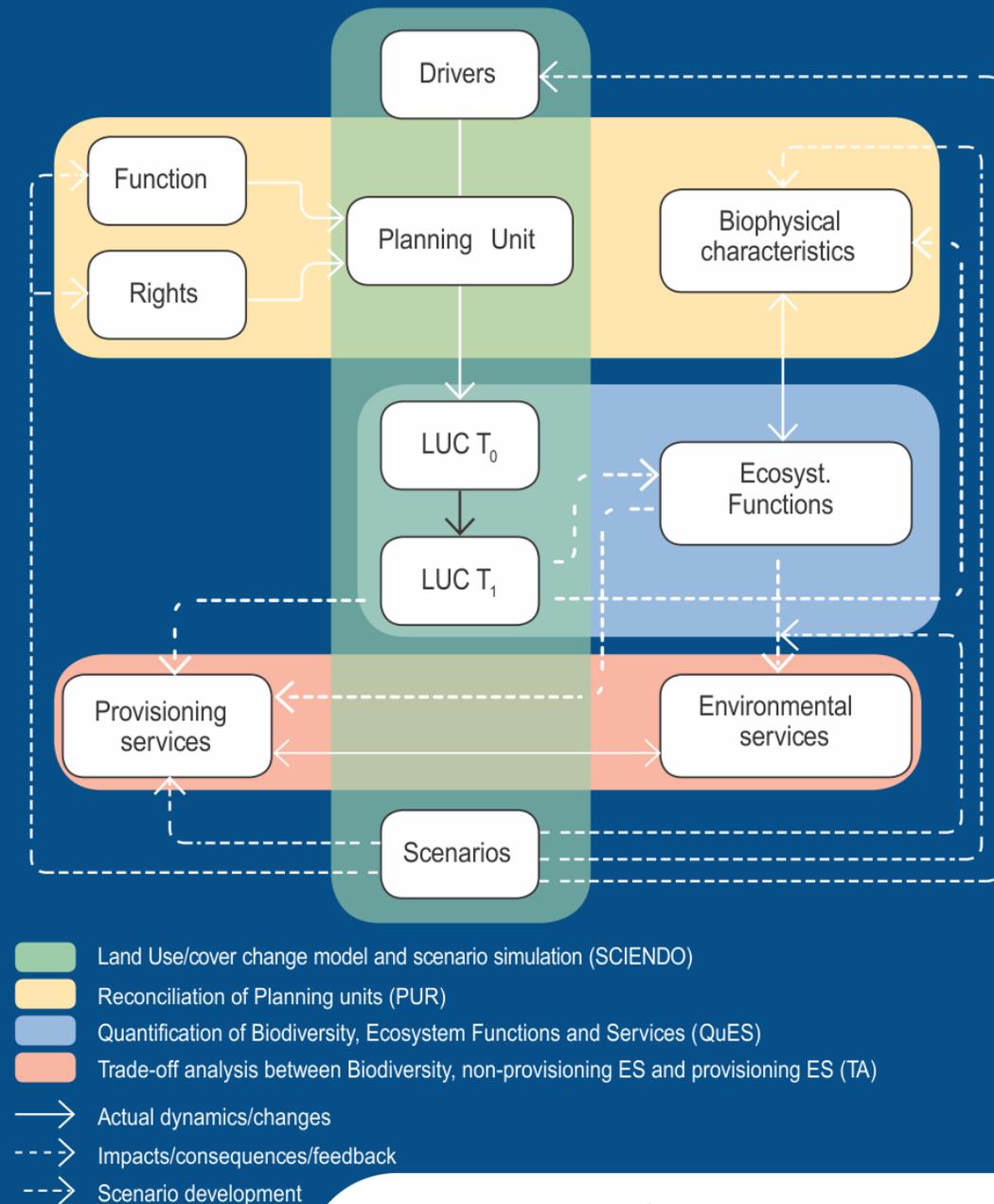
INCLUSIVE · INFORMED · INTEGRATIVE

LUMENS (*Land Use Planning for Multiple Environmental Services*) merupakan sebuah kerangka kerja yang dilengkapi perangkat lunak yang mudah digunakan dan terbuka untuk umum, guna mendukung proses negosiasi para pihak yang inklusif, terpadu, dan berbasis data dalam perencanaan penggunaan lahan untuk bentang lahan yang berkelanjutan. Kerangka kerja ini mendukung penghidupan dan pertumbuhan ekonomi dengan menyeimbangkan manfaat jasa lingkungan dan kelestarian keanekaragaman hayati.



Proses Teknis

1. Pengembangan **unit perencanaan**
2. Analisis **perubahan penggunaan dan tutupan lahan** terkait unit perencanaan.
3. Kuantifikasi **keanekaragaman hayati dan jasa lingkungan**
4. Pengembangan **skenario penggunaan lahan** masa depan dan proyeksi dampak pada jasa lingkungan;
5. Pengembangan skenario yang bertujuan untuk **mengubah business-as-usual (BAU)**
6. Proyeksi LULCC masa depan melalui **pemodelan yang eksplisit secara spasial**
7. Melakukan **analisis trade-off** dari berbagai skenario antar jasa lingkungan
8. Perumusan **rencana aksi**, termasuk instrumen yang diperlukan untuk mengimplementasikan skenario yang disepakati



LUMENS Software

LUMENS dilengkapi dengan perangkat lunak yang mudah digunakan dan gratis



Planning Unit Reconciliation (PUR)

Mengembangkan zonasi atau unit perencanaan yang tepat dalam bentang lahan yang sesuai dengan tujuan untuk mencapai bentang lahan berkelanjutan dari perspektif lokal, kebijakan dan ilmiah.



Quantification of Environmental Services (QuES)

Mengukur jasa lingkungan di tingkat bentang lahan untuk menyokong penghidupan dan pembangunan, serta peranannya dalam penyerapan karbon, siklus hidrologi dan keanekaragaman hayati



Trade-off analysis (TA)

Menganalisis keseimbangan antara potensi pendapatan berbasis lahan dan perekonomian regional, dengan jasa lingkungan



Scenario analysis and Simulation (SCIENDO)

Menyimulasikan skenario perubahan penggunaan lahan berdasarkan intervensi atau perubahan praktik penggunaan lahan

LUMENS Software

Karakteristik utama yang menjadi keunggulan LUMENS:

- Berdasarkan hasil penelitian ilmiah
- Modular
- *Open-source*
- Gratis untuk semua orang
- Terbuka untuk dikembangkan semua pihak
- Terus menerus dikembangkan dan diperbaharui

The screenshot displays the LUMENS software interface. At the top, a table of contents lists sections from 1 Introduction to 5.2 Pre-QuES Land Use/Cover Change Trajectories Analysis Results at the Planning Unit Level. The current view is '5.1 Land Use/Cover Trajectory Analysis Results at the Landscape Level', which includes a map titled '5.1.1 Map of Land Use/Cover Change Trajectories'. The map shows a geographical area with various colored regions representing different land use/cover trajectories. A legend on the right side of the map lists categories such as 'Kehilangan hutan m', 'Stabil', 'Konversi menjadi ag', 'Konversi menjadi pe', 'Konversi menjadi be', and 'Konversi menjadi pe'. Below the map is a table with columns 'Freq' and 'Ha'.

Freq	Ha
596,209	3,726,306
497,493	3,109,331
120,800	755,000
72,184	451,150

The main dashboard features the LUMENS logo with the tagline 'INCLUSIVE · INFORMED · INTEGRATIVE'. Below the logo are four main functional areas: PUR (with buttons for Build, Reconcile, and LASEM), QUES (with buttons for Pre-QUES, QUES-C, QUES-B, and QUES-H), TA (with buttons for LU Profitability, RE Descriptive, and RE Projection), and SCIENDO (with buttons for Scenario Builder, Train Model, and Simulate). At the bottom of the dashboard, a disclaimer states: 'LUMENS is free software and comes with ABSOLUTELY NO WARRANTY. Users are responsible for the results generated. Results depend on the quality of the input data ('garbage in, garbage out') and may vary or be sensitive to the parameters used. Please report any problems encountered while using LUMENS as a GitHub issue.'

lumens.or.id

Perangkat lunak LUMENS, panduan pengguna, contoh kasus, dan berbagai materi lainnya tersedia di lumens.or.id



The screenshot shows the homepage of the LUMENS website. At the top left is the LUMENS logo with the tagline "INCLUSIVE · INFORMED · INTEGRATIVE". To the right is a navigation menu with links for "Beranda", "Tentang", "Studi Kasus", "Sumber Daya", "Bantuan", and a language dropdown set to "ID". The main heading reads "Land-use Planning for Multiple Environmental Services". Below this is the subtitle "Perencanaan Tata Guna Lahan untuk Beragam Jasa Lingkungan" and the tagline "INKLUSIF • TERINFORMASI • TERPADU". A paragraph describes LUMENS as an open-source framework for sustainable land use planning. A prominent blue button with a white download icon says "Unduh Software LUMENS". On the right side, there are four overlapping images: a landscape with trees, a close-up of hands holding soil, a field of crops, and a forest.





Planning Unit

Suatu kawasan dalam bentang alam yang menyatu, yang memiliki **kesamaan karakteristik biofisik dan sosial-ekonomi** serta **fungsi yang telah ditetapkan**, untuk dijadikan **landasan perencanaan tata guna lahan di masa depan**.



Landasan Teori PUR

Planning Unit Reconciliation (PUR) adalah modul yang digunakan untuk konstruksi unit perencanaan dengan tujuan meliputi:

- **Identifikasi isu dan tumpang tindih penunjukkan kawasan/zona dalam tata guna lahan**
- **Menghasilkan peta unit perencanaan yang disepakati parapihak (misal, penunjukkan area dan izin).**

PUR

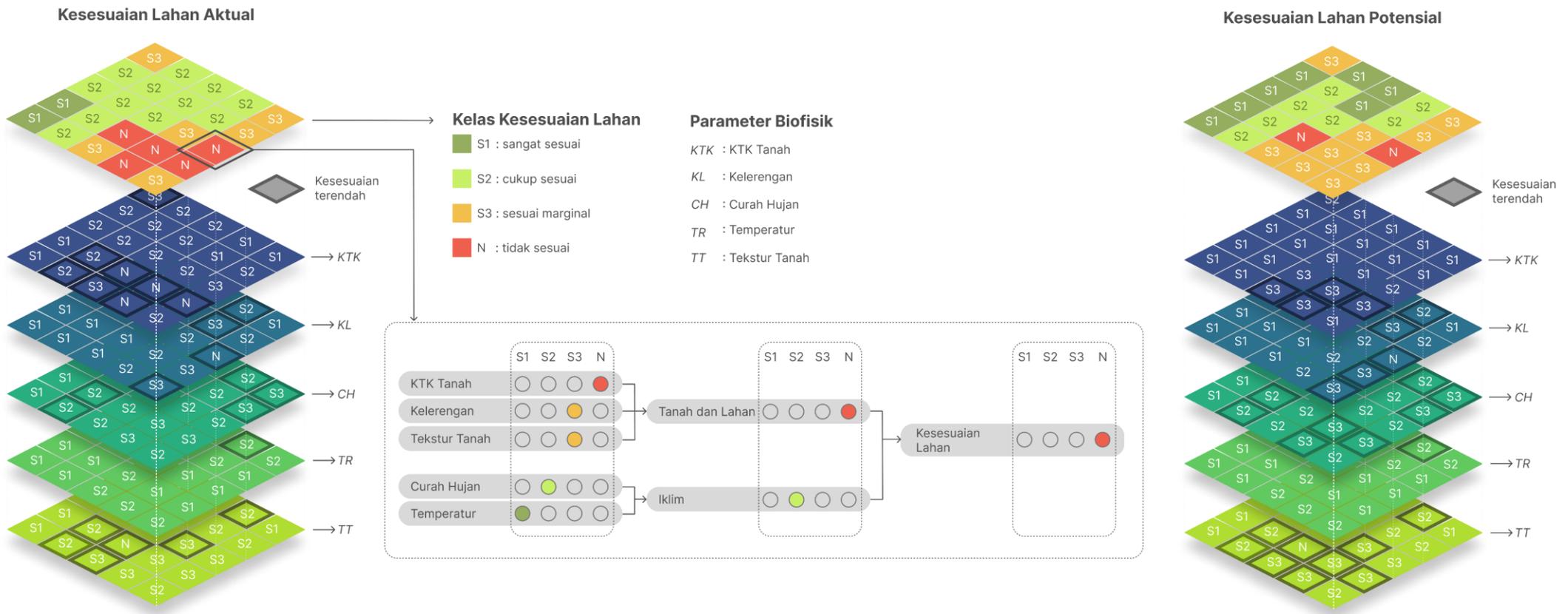




Landasan Teori LaSEM

(Land Suitability Evaluation Module)

LaSEM (Land Suitability Evaluation Module) dibangun berdasarkan kerangka evaluasi kesesuaian lahan (yaitu FAO 1976, 2007). Kerangka ini membagi lahan menjadi dua kelompok utama: **cocok untuk tanaman (S)** dan **tidak cocok untuk tanaman (N)**.



PUR Build Module

Reference Map

Browse... input shapefiles (.shp, .dbf, .shx, .prj)

Reference Class

Browse... input table (.csv)

Reference Class of Reference Map

Browse... input table (.csv)

List of Planning Units

Browse... input table (.csv)

Map Resolution (m)

e.g., 100, 30, etc.

Select Output Directory

Run PUR Build

Return to Main Menu

User Guide | [Log](#)

Overview

Planning unit reconciliation is a process to resolve overlapping permits by referring to function reference maps. Permit data can include things like forest management concessions, plantation permits, mining permits, and others. Reference data can be spatial planning data or area designation data. PUR Build module construct the overlay of planning units map to identified the overlaped zones.

Data and Input Variables

- Reference Map (Shapefile format)
 - Represents zonation that will become the reference for PUR analysis
- Reference Class (CSV format)
 - Lookup table containing class function that will become the reference for all the planning units. Consist of ID column and Class Definition.
- Reference Class of Reference Map (CSV format)
 - Lookup table containing reference map values (ID) with their corresponding classification of reference class (ID of reference class)
- Planning Unit List (CSV format)
 - Lookup table containing list of planning units (name, identity, and shapefile path) with their corresponding of reference class classification.

Using The Module

Follow these steps to use the module:

PUR Build Module

Reference Map | [User Guide](#) | [Log](#)

Browse... input shapefiles

Overview

PUR Reconcile Module

Built Planning Unit Map

Browse... input shapefiles (.shp, .dbf, .shx, .prj)

Reconciliation Table

Browse... input table (.xlsx)

Map Resolution (m)

e.g., 100, 30, etc.

Select Output Directory

Run PUR Reconcile

Return to Main Menu

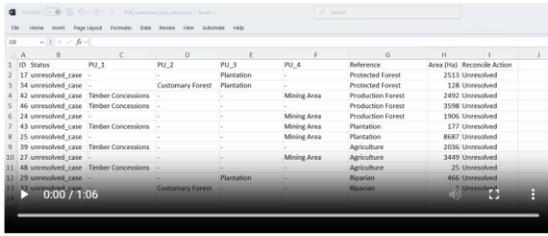
User Guide | [Log](#)

Overview

Planning unit reconciliation is a process to resolve overlapping permits by referring to function reference maps. Reconciliation is done by analyzing how well the permit data matches the reference data.

Data and Input Variables

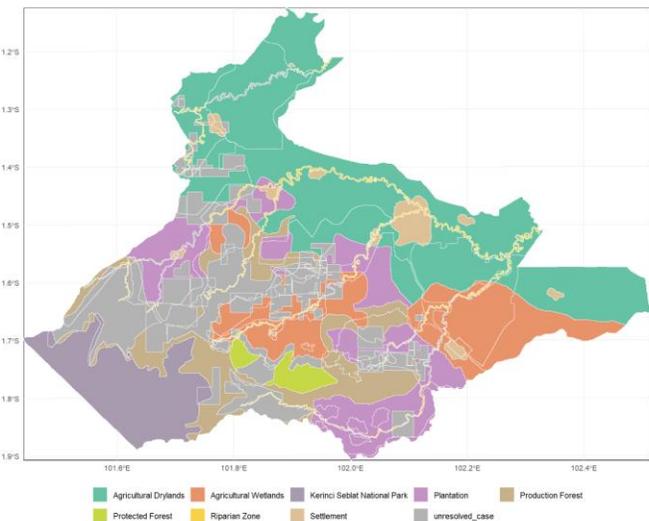
- Unresolved Case Map (Shapefile format)
 - Shapefile of overlaped planning units with some layer that conflict, defined as unresolved case.
- Unresolved Case Attribute (Excel format)
 - Before running PUR Reconcile module, it is necessary to select the reconcile action on drop-down option for every unresolved case in 'PUR_reconciliation_table.xlsx' file generated from PUR Build module. You can use Microsoft Excel or any free spreadsheet software (e.g., Google Sheet) to do it.



- Summary
- Module brief description
- Input data
- Results
 - 4.1 Unresolved Cases Zone Map**
 - 4.2 Summary of Unresolved Cases

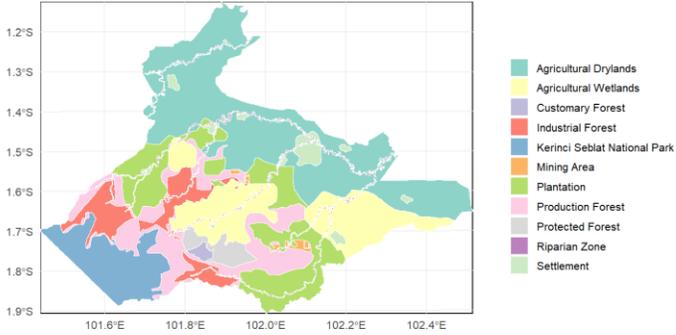
4 Results

4.1 Unresolved Cases Zone Map



- Summary
- Module brief description
- Results
 - 3.1 Reconciliation Results Map**
 - 3.2 Reconciliation Data Summary

3.1 Reconciliation Results Map





DEMO

Planning Unit Reconciliation (PUR)

SCAN UNTUK
MELIHAT CONTOH
HASIL





Quantification of Environmental Services

Memodelkan **proses ekologis dan hidrologis** berdasarkan proyeksi perubahan tata guna lahan dari berbagai skenario pembangunan, guna **mengukur perubahan pada stok karbon, fungsi hidrologis, dan keanekaragaman hayati.**



Quantification of Ecosystem Services (QuES)



Land Use Changes

Analisis rangkaian peta yang menggambarkan penggunaan lahan serta perubahan penggunaannya di suatu wilayah dalam suatu periode waktu



Water

Perubahan fungsi hidrologi di setiap sub-daerah aliran sungai: debit air, sedimentasi, dan kapasitas penyangga.



Carbon

Dinamika stok karbon yang dipengaruhi oleh aktivitas pertanian, perubahan penggunaan lahan, dekomposisi gambut, dan kebakaran.

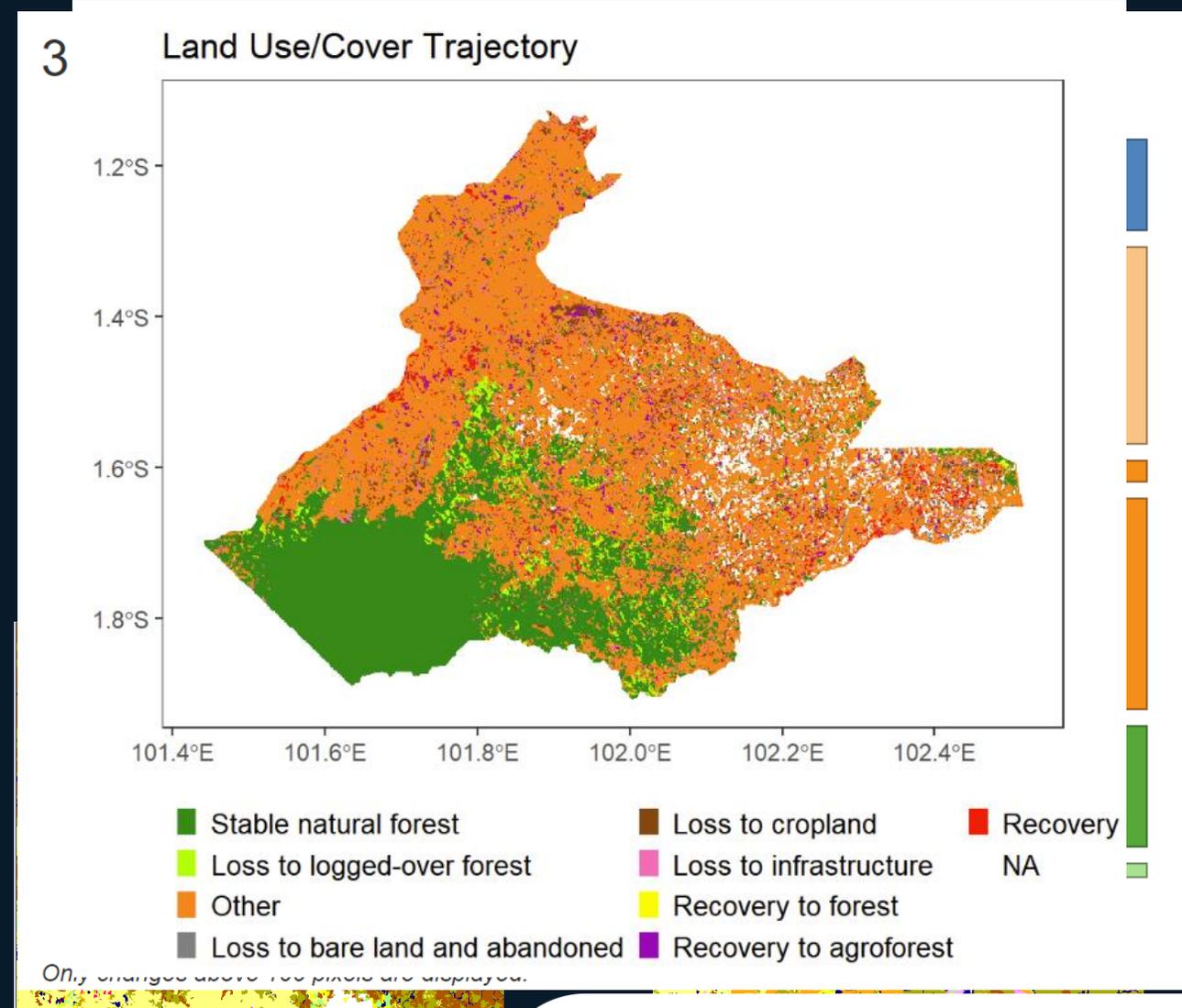


Biodiversity

Analisis keanekaragaman hayati yang dipengaruhi oleh kualitas dan pola habitat, seperti tingkat fragmentasi dan keterpaduannya.

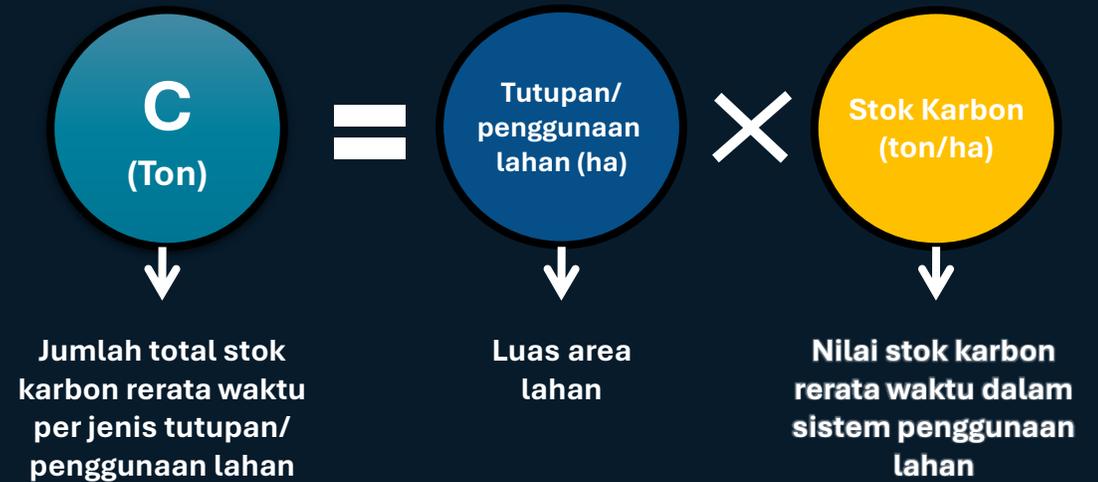
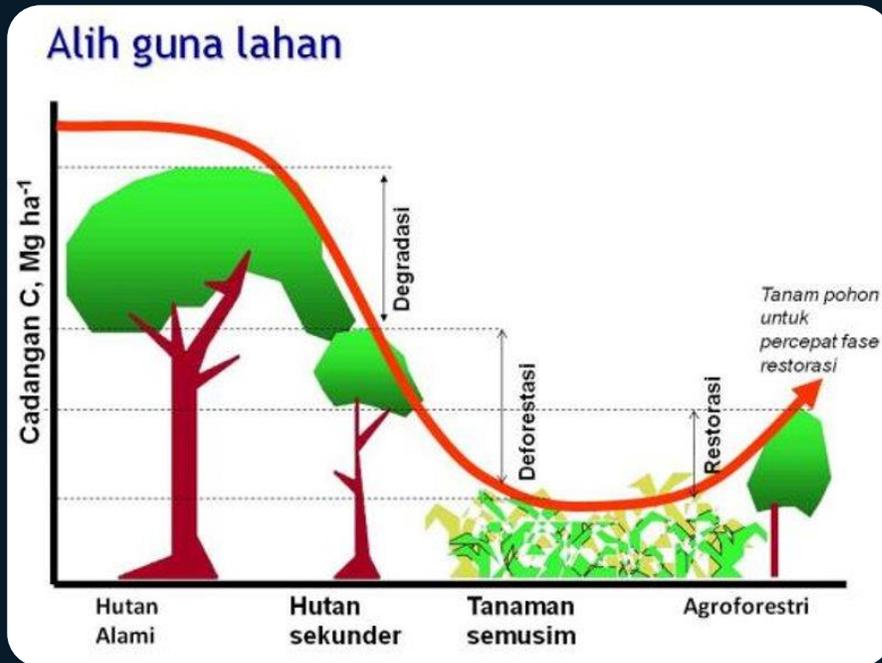
Landasan Teori Pre-QuES

- Analisis perubahan penggunaan lahan/penutup lahan dan trajektorinya menggunakan pendekatan *post-classification comparison*.
- Data yang digunakan meliputi peta tutupan lahan multiwaktu hasil interpretasi data penginderaan jarak jauh atau pemetaan terrestrial, dan peta unit perencanaan
- Menghasilkan **peta & statistik perubahan tutupan/penggunaan lahan**, serta **matriks transisi penggunaan lahan**



Landasan Teori QuES-C

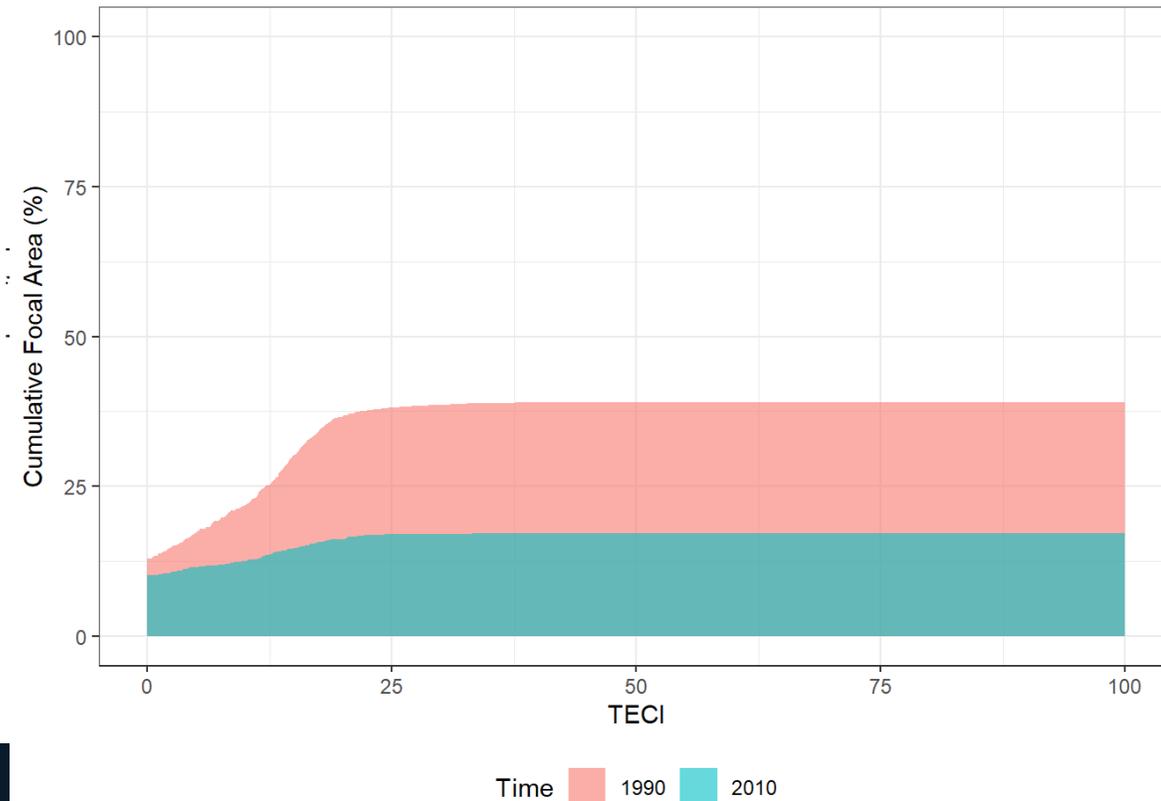
Modul QuES-C menggunakan pendekatan **Stock-Difference** dalam mengestimasi perubahan cadangan karbon sebagai dasar estimasi emisi karbondioksida



Landasan Teori QuES-B

- Menggambarkan **kondisi keanekaragaman hayati** pada tingkat **bentang lahan**, dengan fokus pada **komposisi dan konfigurasi suatu focal area**, melalui Indeks Tingkat Integrasi Area Fokal (**DIFA**).
- **Peta Total Edge Contrast Index (TECI)** menampilkan sebaran spasial fragmentasi dan integrasi area fokal, berdasarkan tingkat kontras antara jenis tutupan/penggunaan lahan yang berdampingan.
 - Menunjukkan kontribusi berbagai tipe penggunaan lahan sebagai habitat & koridor untuk pergerakan flora dan fauna.
 - Memonitor kehilangan/kerusakan akibat perubahan penggunaan lahan.

Degree of Integration of Focal Area



Landasan Teori QuES-H

Modul QuES-H menggunakan metode:

RUSLE (*Revised Universal Soil Loss Equation*)

Metode telah digunakan secara luas oleh pengelola lahan untuk mengestimasi erosi tanah yang disebabkan oleh air.

Factor R (Erosivitas)

Factor K (Erodibilitas)

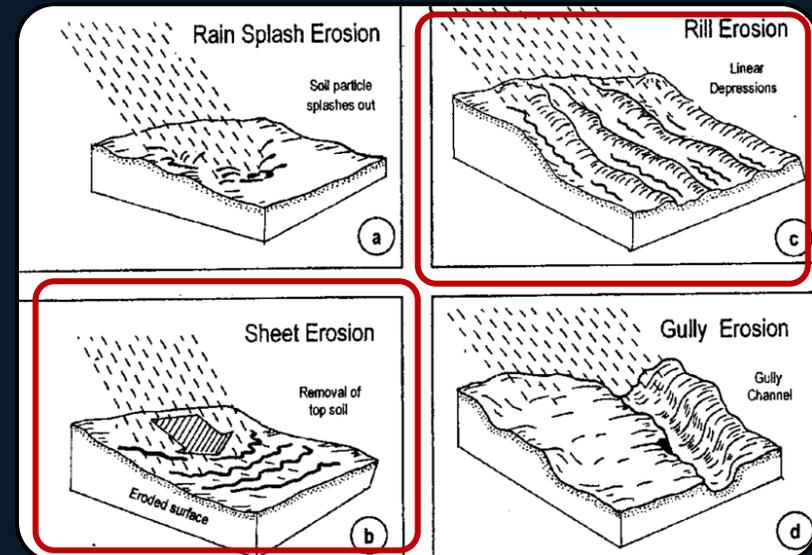
Factor C (Pengelolaan tutupan lahan)

Factor LS (Panjang & Kecuraman Lereng)

Factor P (Praktik-pratik pendukung)

Pendekatan RUSLE mengestimasi rerata tahunan kehilangan tanah (A dalam $ton \cdot ha^{-1} \cdot tahun^{-1}$)

QuES-H memperkirakan rata-rata kehilangan tanah tahunan akibat erosi lapisan dan erosi alur pada bagian-bagian lanskap yang mengalami erosi, tetapi tidak mengalami sedimentasi.



Pre-QuES Module

Land Use/Cover T1

Browse... No file selected

T1 Year

1990

Land Use/Cover T2

Browse... No file selected

T2 Year

2010

Land Use/Cover Lookup Table (CSV)

Browse... No file selected

Trajectory Lookup Table (CSV)

Browse... No file selected

Planning Units (Shapefile)

Browse... Upload the .shp, .dbf, .prj, and .shx files.

Select Output Directory

Run Pre-QuES Analysis

Return to Main Menu

QUES-C Analysis

Land cover map at T1

Browse... No file selected

Year of T1

1990

Land cover map at T2

Browse... No file selected

Year of T2

2000

Carbon stock lookup table

Browse... No file selected

Planning Unit

Browse... input shapefiles (.shp, .dbf, .prj, .shx)

Select output directory

Run

Return to Main Menu

User Guide Log

Overview

The Quantification of Environmental Services for Carbon (QUES-C) module calculate the amount of green-house gas emission from land use/cover change using stock difference approach. The stock difference approach estimates GHG emissions or removals from land-use change by calculating the change in carbon stocks over time. This involves comparing the carbon stored in different land-use types at two points in time, using Activity Data that quantifies the extent of land-use change, and Emission Factors that represent the carbon stock changes associated with each land-use transition. By multiplying the Activity Data with the corresponding Emission Factors, we can determine the net GHG emissions or removals resulting from land-use change within a given area and time period.

Key Concepts:

- Carbon stock dynamics analysis** is carried out for carbon stock changes in an area during one period, using *Stock Difference* method. The carbon stock being considered is time-averaged above ground carbon stock.
- Emissions** are calculated as the decrease of carbon stock amount due to land cover change if the amount of the initial carbon stock is higher than that upon land use change.
- Sequestration** is calculated as the amount of carbon stock addition due to land cover change (meaning that the carbon stock in the initial land use is lower than that upon land use change)

Data Preparation

Before using the QUES-C Analysis tool, prepare the following:

- Land Cover Maps:** Two raster files (GeoTIFF format) representing land use/cover for two different time points.
- Planning Unit Map:** A raster file (GeoTIFF format) or shapefile of administrative or management zones.
- Carbon Stock Lookup Table:** A CSV file describing emission factors with their corresponding land cover classes.

Using the QUES-C Analysis Tool

Follow these steps to use the tool:

QUES-C Analysis

Land cover map at T1

Year of T1

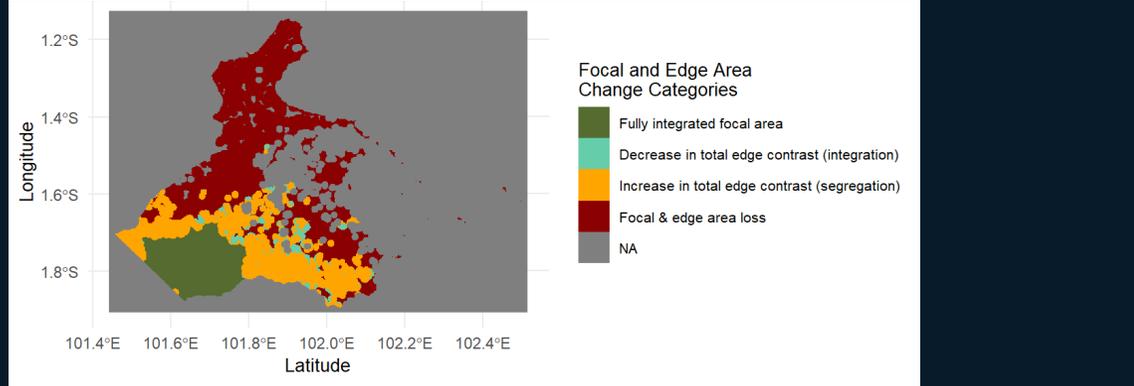
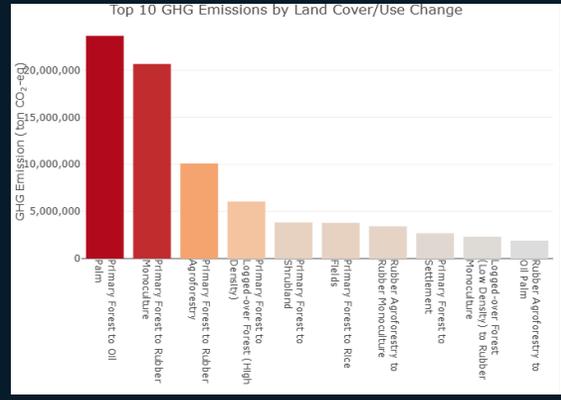
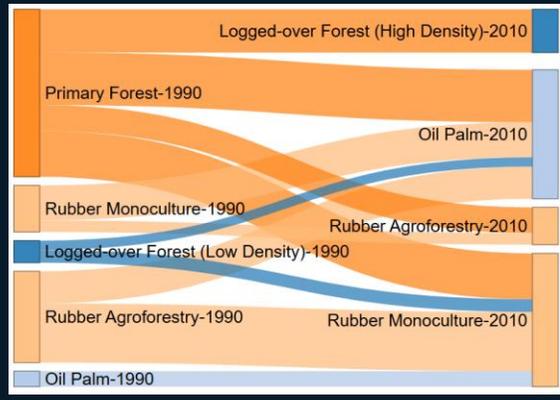
Land cover map at T2

Year of T2

Carbon stock lookup table

Planning Unit

Key Concepts:



QuES-B Module

Multiple Time Series Analysis

Single Step

Two Step

Land Cover/Use Map

Browse... input raster (.tif)

Year

2005

No Data Class

0

Land Use/Cover & Focal Area Lookup Table (CSV)

Browse... No file selected

Edge Contrast Table (FSQ)

Browse... No file selected

Sampling Points (n)

1000

Window Size (metres)

1000

Window Shape

Circle

FRAGSTATS Configuration

Browse... (Optional)

QuES-H Module

Total Annual Precipitation Map

Browse... input raster (.tif)

Elevation Map

Browse... input raster (.tif)

Sand Content Map

Browse... input raster (.tif)

Silt Content Map

Browse... input raster (.tif)

Clay Content Map

Browse... input raster (.tif)

Organic Content Map

Browse... input raster (.tif)

Planning Unit Map

Browse... input shapefiles (.shp, .dbf, .prj, .shx)

C Factor Attribute

Browse... input table (.csv)

Map Resolution (m)

P Factor Map Available?

Yes

No

The P factor is assumed to have a value of 1

Multiple Time Series Analysis

Single Step

Two Step

Land Cover/Use Map

User Guide Log

Overview

QuES-H (Quantification of Ecosystem Services) is a hydrological assessment module that analyzes hydrological environmental services. The current version features a soil erosion risk module based on the Revised Universal Soil Loss Equation (RUSLE), with plans to expand its capabilities to include additional hydrological analyses in the future.

Key Concepts

The Revised Universal Soil Loss Equation (RUSLE) is an empirical model widely used in soil conservation and watershed management. It provides a method for estimating annual soil loss due to water erosion. Key features of RUSLE is predicting long-term average annual soil loss.

RUSLE can support for land use planning and soil conservation strategies in several ways, including quantifying soil erosion risk across landscapes, identifying areas prone to high erosion rates, and comparing soil loss rates under various land management scenarios.

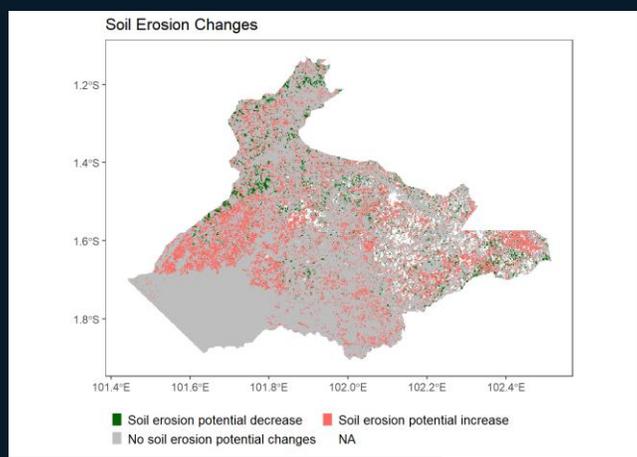
The RUSLE Equation

$$A = R \times K \times LS \times C \times P$$

RUSLE is a multiplicative model where each factor influences the overall soil loss. Soil loss (A) is the average annual soil loss per unit area (tons per hectare per year). All factors except R and K are dimensionless. The model can be applied at field, watershed, or regional scales, depending on data availability.

Components

- R factor (Rainfall-runoff erosivity)**
Requires long-term rainfall data, preferably 20+ years. Often estimated from annual precipitation, or obtained from pre-calculated maps
- K factor (Soil erodibility)**
Based on soil texture, organic matter content, structure, and permeability.
- LS factor (Slope length and steepness)**





DEMO

Quantification of Environmental Services (QuES)

SCAN UNTUK
MELIHAT CONTOH
HASIL





Projection of Future Scenarios

Proyeksi penggunaan dan perubahan penggunaan lahan dalam suatu skenario pembangunan dilakukan sebelum skenario tersebut dijalankan atau diselesaikan, dengan **mempertimbangkan faktor-faktor yang memengaruhi penggunaan & perubahan lahan.**



Landasan Teori SCIENDO

Proses proyeksi dalam modul SCIENDO menggunakan pendekatan:

Analisis kebutuhan lahan melalui **Matriks Transisi**

Identifikasi kebutuhan lahan berdasarkan kebutuhan yang dirumuskan dalam dokumen perencanaan. Proses perumusan perlu dilakukan secara inklusif, terintegrasi dan terinformasi.

Berapa luas tutupan/penggunaan lahan yang berubah.

Weight of Evidence (WoE)

WoE atau bobot bukti merupakan metode identifikasi faktor-faktor yang memberikan pengaruh pada terjadinya perubahan tutupan/penggunaan lahan.

WoE menunjukkan **di mana** perubahan penutupan lahan mungkin terjadi

Spatially Explicit

Keseluruhan proses proyeksi dilakukan dengan basis data spasial untuk memetakan di mana perubahan serta berapa luasan yang berubah.

Landasan Teori SCIENDO



ex-ante impacts

Dampak ekonomi, sosial, dan lingkungan yang **diperkirakan akan terjadi** sebagai konsekuensi dari skenario perubahan tata guna lahan dan penutupan lahan, **sebelum skenario tersebut diterapkan.**

Analisis dilakukan secara **ex ante** untuk memahami potensi risiko, manfaat, dan *trade-off* dari berbagai pilihan pembangunan.





DEMO

Scenario analysis and Simulation (SCIENDO)

SCAN UNTUK
MELIHAT CONTOH
HASIL





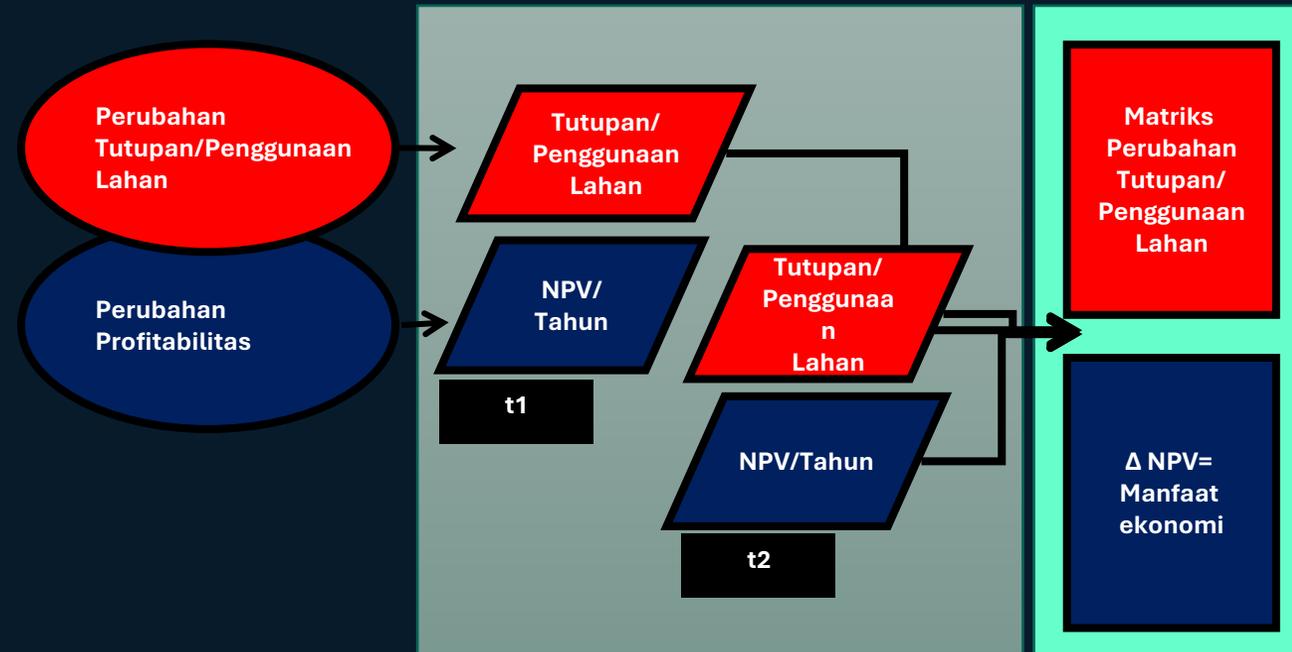
Trade-off analysis

Analisis **dampak positif dan negatif** yang diperkirakan sebelumnya (*ex-ante*) terhadap **indikator utama di bidang sosial, ekonomi, dan lingkungan dalam berbagai skenario pembangunan.**



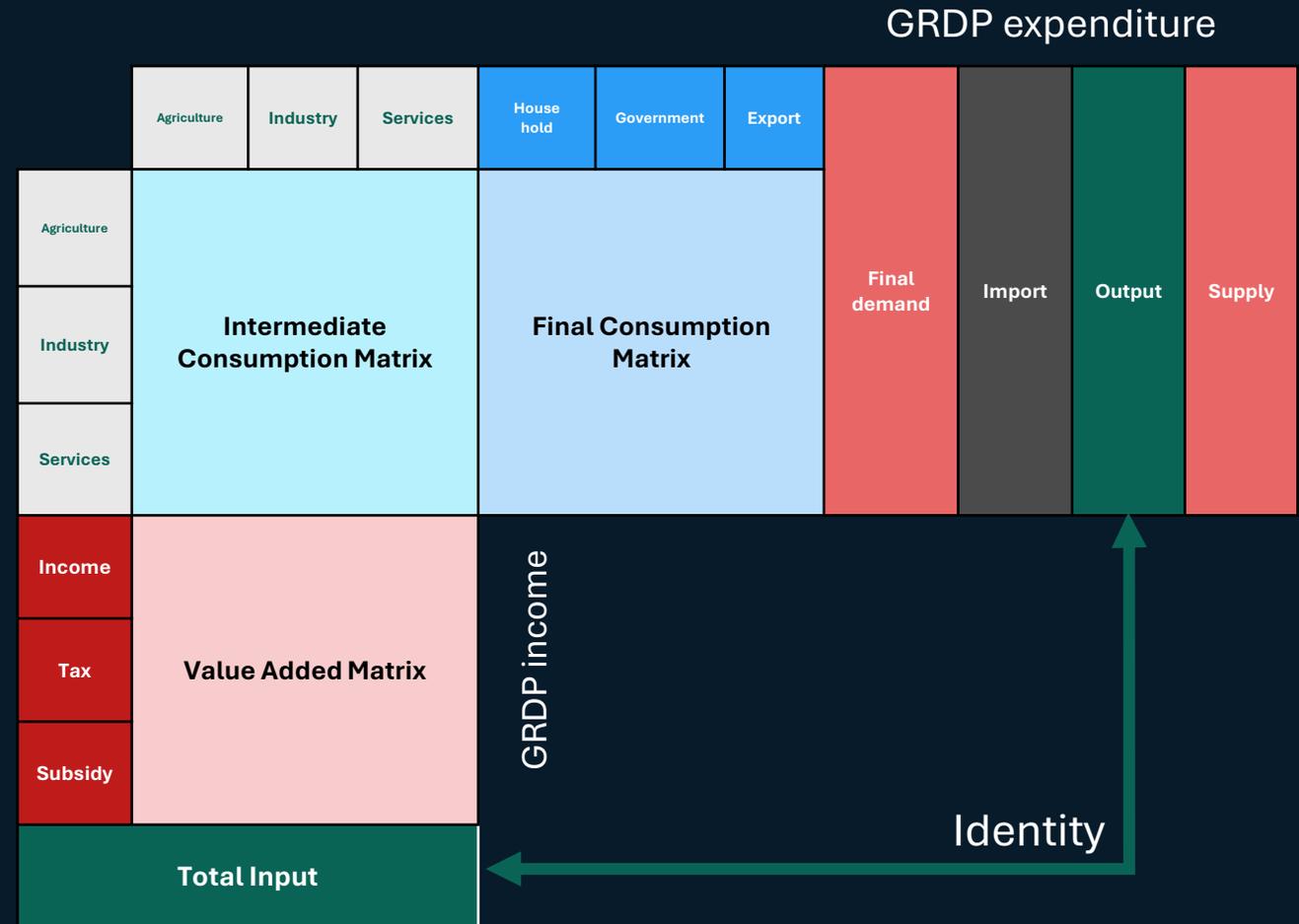
Landasan Teori TA-Profitability

- Perbandingan biaya dan manfaat di berbagai skenario pembangunan, dengan mempertimbangkan dampaknya berdasarkan sejumlah indikator. Salah satu indikator yang dihitung saat ini adalah **Net Present Value (NPV)**
- NPV menghitung nilai bersih arus kas masa depan dalam satu siklus, didiskon ke nilai saat ini.
Investasi menguntungkan jika $NPV > 0$
- Bagaimana membandingkan keuntungan dari tanaman A dan B dengan siklus tanam berbeda? “**EAE (Equivalent Annual Earnings)** mengubah total NPV menjadi nilai tahunan setara → memungkinkan perbandingan antar sistem”
- Keuntungan Usaha Tani dihitung sebagai:
 $NPV \text{ tahunan } (Rp) \times \text{Luasan } (ha)$



Landasan Teori TA – Ekonomi Regional

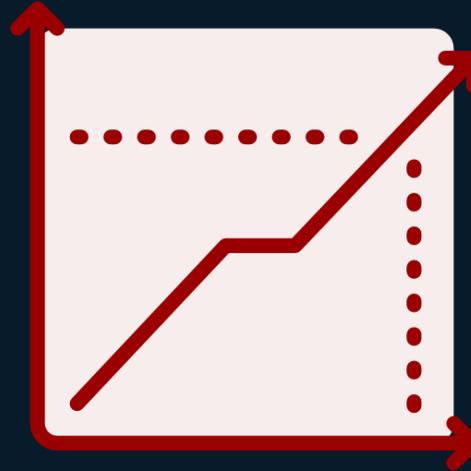
- Kerangka kerja untuk memahami, menganalisis, dan memprediksi perilaku ekonomi di dalam wilayah (seperti kabupaten atau provinsi), dengan mengkaji interaksi antar sektor ekonomi.
- Modul ini berfokus pada distribusi spasial aktivitas ekonomi, alokasi sumber daya, dan konsumsi di dalam suatu wilayah.
 1. **Analisis Ekonomi Regional**
Wawasan tentang indikator ekonomi kunci seperti **PDRB, kontribusi sektor, tenaga kerja, dan distribusi pendapatan.**
 2. **Proyeksi Ekonomi Regional**
Menganalisis dinamika ekonomi regional, memberikan **hasil perbandingan antara skenario *business-as-usual* (BAU) dan skenario alternatif.**





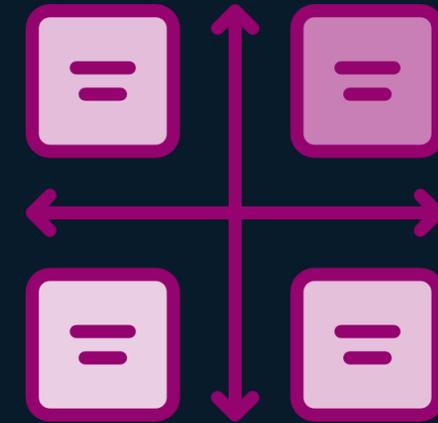
Land Use Profitability

Analisis biaya dan manfaat di tingkat pertanian yang dipetakan ke tingkat lanskap untuk memahami dampaknya terhadap para petani dan produsen komoditas lainnya dalam berbagai skenario Pembangunan.



Regional Economy

Analisis model Tabel Input-Output, mencakup PDRB, ketenagakerjaan, pemerataan, keterkaitan antar sektor, efek pengganda, dan bagaimana semua itu berubah dalam berbagai skenario pembangunan.



Selecting best scenario

Proses negosiasi berbasis informasi untuk menentukan skenario terbaik dalam merespons aspirasi berbagai pemangku kepentingan, guna mewujudkan lanskap multifungsi dan pembangunan berkelanjutan di sektor berbasis lahan dan sektor terkait.

Profitability Analysis

Land cover map at T1

Browse... No file selected

Year of T1

1990

Land cover map at T2

Browse... No file selected

Year of T2

2000

Planning Unit Raster

Browse... No file selected

User Guide Log

Overview

The Profitability Analysis module enables users to assess the economic benefits of land-use change scenarios by calculating Net Present Value (NPV). It evaluates both financial and environmental impacts, helping to identify trade-offs between economic development and environmental sustainability.

Key Concepts:

- Net Present Value (NPV):** A financial metric that calculates the current value of future cash flows generated by a project or investment, accounting for the time value of money. It helps assess the profitability of different land-use scenarios.
- Economic Benefits:** The financial gains derived from land-use changes, encompassing revenue generation, cost savings, and potential investments in sustainable practices. This analysis aids decision-makers in balancing economic and environmental goals.

Data and Input Variables

Before using the Profitability Analysis tool, prepare the following:

- Land Cover Maps First Year:** A categorical raster file in GeoTIFF format representing land use types for the start year. This file

User Guide Log

Overview

The Regional Economic Descriptive Analysis module in LUMENS assesses the economic dynamics of a region by examining key indicators like GDP, sectoral contributions, employment, and income distribution. This analysis provides valuable insights into the economic drivers behind land use and resource allocation. By understanding these trends, stakeholders can make informed decisions to balance economic growth with sustainable land use, improve livelihoods, and optimize land-use policies, addressing real-world challenges in regional development.

Key Concepts:

- Economic Sectors:** Distinct areas of economic activity such as agriculture, industry, and services. Each sector plays a vital role in regional economic performance, contributing to overall growth and employment.
- Intermediate Demand:** Represents the demand for goods and services used as inputs in the production processes of domestic industries, excluding final consumption or capital investments. It provides insights into the interconnectedness of sectors.
- Final Demand:** The total demand for goods and services within the region, including consumption by households, government, exports, and investments. It is a critical measure of the economic output required to meet regional needs.
- Added Value:** The economic value added by each sector, calculated as revenue minus intermediate consumption. This metric highlights the profitability and productivity of individual sectors, providing a clear picture of their contribution to regional economic growth.
- Labour Distribution:** Refers to the allocation of employment across various economic sectors, illustrating how labor is utilized in different industries and contributing to regional job creation and economic stability.
- Land Use Distribution:** The allocation of land resources among different economic sectors, reflecting how land is utilized for agricultural, industrial, and other purposes within the region. This provides insight into the balance between economic activities and land management.

Data and Input Variables

Before using the Regional Economic Descriptive Analysis tool, prepare the following:

- Sector:** A CSV file categorizing economic sectors such as agriculture, industry, or services. This defines the primary areas of economic activity within the region.
- Intermediate Demand:** A CSV file containing numerical data on the purchase of commodities by domestic industries as inputs to production, excluding capital investments.
- Final Demand Component:** A CSV file with numerical data representing the total demand for economic output across all sectors within the region.
- Final Demand:** A CSV file that provides a comprehensive view of the total economic output demanded by all sectors within the region.
- Added Value Component:** A CSV file with numerical data reflecting the sum of unit profits, calculated as revenue minus intermediate consumption, for each economic sector.

User Guide Log

Overview

The Regional Economic Projection module in LUMENS analyzes the economic dynamics of a region, comparing outcomes between Business-As-Usual (BAU) and alternative development scenarios. By incorporating land requirements and scenario data, this module enables policymakers to assess different pathways for sustainable land use, enhance livelihoods, and inform land-use policy decisions. It provides a comprehensive projection of future economic conditions, helping to optimize strategies for regional development and resource management.

Key Concepts:

- Economic Sectors:** Distinct areas of economic activity such as agriculture, industry, and services. Each sector plays a vital role in regional economic performance, contributing to overall growth and employment.
- Intermediate Demand:** Represents the demand for goods and services used as inputs in the production processes of domestic industries, excluding final consumption or capital investments. It provides insights into the interconnectedness of sectors.

Regional Economic Descriptive Analysis

Sector table

Browse... No file selected

Intermediate Demand table

Browse... No file selected

Final Demand Component table

Browse... No file selected

Final Demand table

Browse... No file selected

Added Value Component table

Browse... No file selected

Added Value table

Browse... No file selected

Labour table

Browse... No file selected

Land Distribution table

Browse... No file selected

Land Use map

Browse... Please input your raster file

Land Use Lookup Table

Browse... No file selected

Unit

Regional Economic Projection

Land Requirement Database

Browse... Input RData file from TA Regeco 1

SCIENDO Database

Browse... Input your CSV file

Select Output Directory

Run Analysis

Return to Main Menu

2.2.1 Dryland Agriculture

2.2.1.1 Top 10 ΔNPV di Dryland Agriculture

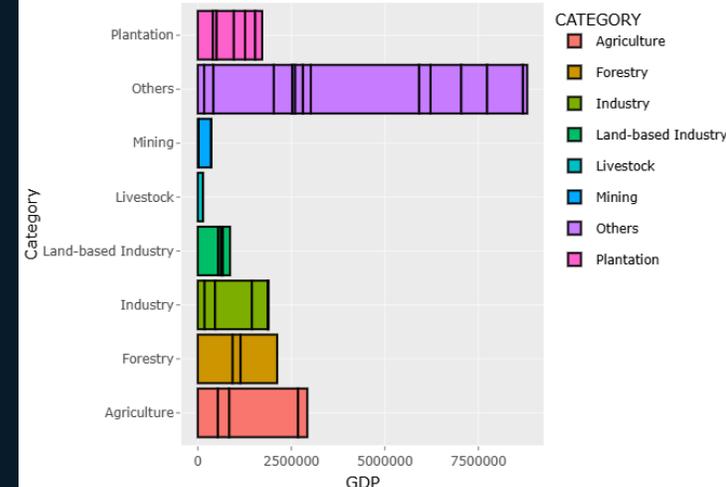
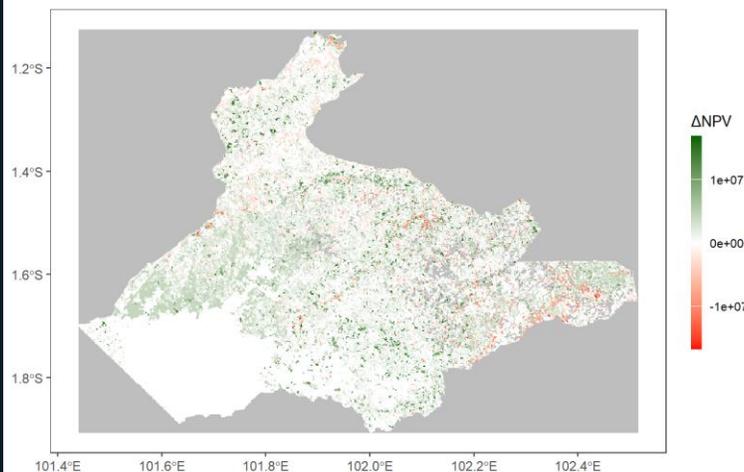
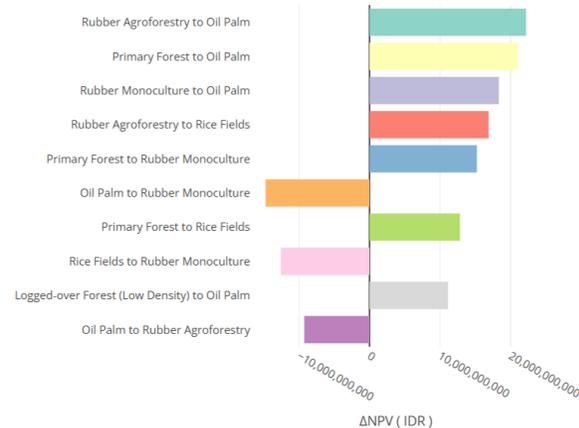
2.2.1.2 Tabel Nilai Total untuk Dryland Agriculture

2.2.1.3 Top 10 NPV berdasarkan Tutupan Lahan 1 di Dryland Agriculture

2.2.1.4 Top 10 NPV berdasarkan Tutupan Lahan 2 di Dryland Agriculture

2.2.1.5 Seluruh Transisi LULCC di Dryland Agriculture

Top 10 ΔNPV in PU: Dryland Agriculture



Sector	Category	GDP_bau	GDP_scn_Period_1	GDP_scn_Period_2	GDP_scn_Period_3
Paddy	Agriculture	1,844,811.70	1,697,165.7	1,722,422.3	1,717,819.1
Tuber Crops	Agriculture	305,055.43	317,291.6	353,986.4	377,735.0
Vegetables and Fruits	Agriculture	531,519.22	527,192.7	534,874.8	533,116.1
Other Food Crops	Agriculture	244,451.15	245,511.0	273,870.0	292,239.7
Rubber	Plantation	404,426.45	405,530.7	491,622.0	568,720.7
Coconut	Plantation	271,612.90	510.9	516.9	516.9
Oil Palm	Plantation	466,895.34	456,711.4	492,711.2	534,717.6
Coffee	Plantation	299,869.78	334.6	400.6	459.9
Cinnamon	Plantation	184,711.61	4.9	5.2	5.4
Other Plantation Crops	Plantation	92,271.69	88,026.8	88,865.7	88,270.2

Showing 1 to 10 of 46 entries

Previous 1 2 3 4 5 Next





DEMO

Trade-off analysis (TA)

SCAN UNTUK
MELIHAT CONTOH
HASIL



Contoh Penggunaan di Provinsi Nusa Tenggara Timur



Indikator Makro Pertumbuhan Ekonomi Hijau

 Laju deforestasi 1	 Laju perluasan tutupan pohon 2	 Laju perluasan agroforestri 3	 Emisi GRK (berbasis lahan) 4
 Emisi (sumber lain) 5	 Sekuestrasi GRK 6	 Fragmentasi habitat/DIFA 7	 Sedimentasi (ketahanan air) 8
 Aliran permukaan (ketahanan air) 9	 Penurunan risiko bencana kebakaran 10	 Ketahanan Pangan (Ketersediaan, akses & distribusi) 11	 Pendapatan 12
 Keterkaitan sektor lahan dengan sektor lain 13	 Serapan tenaga kerja 14	 Rasio Pendapatan Terhadap Keuntungan Usaha 15	 Rasio Keuntungan usaha tani 16
 Laju pertumbuhan PDRB 17	 Rasio penguasaan lahan oleh masyarakat 18	 Intensitas Emisi 19	<ul style="list-style-type: none"> Indikator Ekonomi Indikator Sosial Indikator Lingkungan

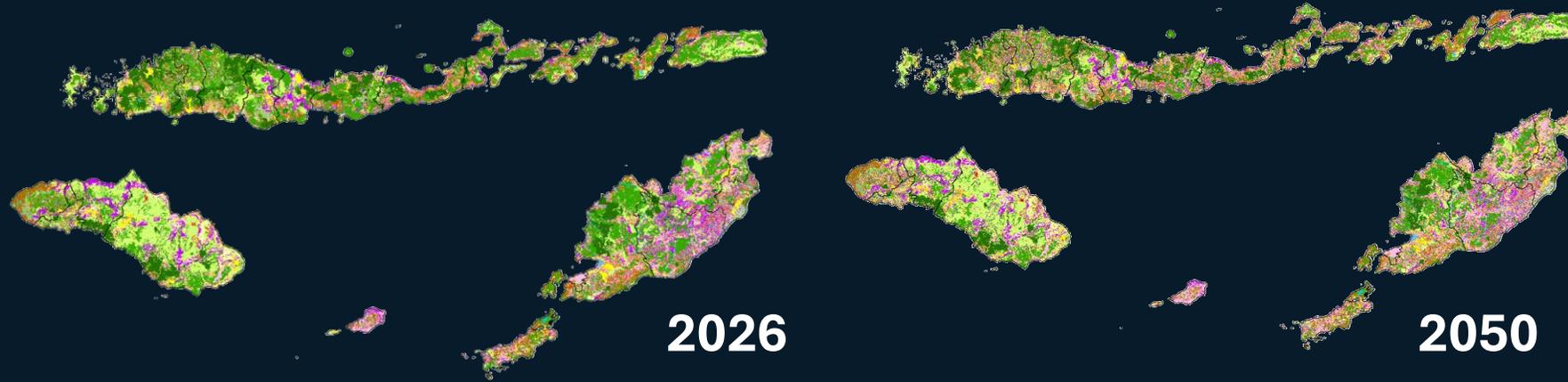


Skenario

- **Skenario BAU (*Business as Usual*)**
disusun berdasarkan rencana-rencana yang sudah ada, seperti rencana pembangunan, rencana induk sektoral, dan rencana tata ruang, yang dipadukan dengan proyeksi tren historis.
- **Skenario GG (*Green Growth*)**
dikembangkan melalui strategi yang didasarkan pada analisis spasial dan pemodelan, analisis faktor pendorong, serta wawancara dan FGD dengan berbagai pihak, termasuk instansi pemerintah, perusahaan, akademisi, LSM, dan kelompok tani, dalam proses yang inklusif dan partisipatif secara menyeluruh.



BAU



2026

2050

GGP



2026

2050

- Hutan lahan kering primer
- Hutan lahan kering sekunder kepadatan tinggi
- Hutan lahan kering sekunder kepadatan rendah
- Hutan mangrove primer
- Hutan mangrove sekunder
- Hutan tanaman cemara
- Jati monokultur
- Mahoni monokultur
- Kemiri monokultur
- Asam monokultur
- Kersen monokultur
- Jambu mete monokultur
- Hutan tanaman monokultur lain (sageput)
- Kakao agroforestasi
- Kopi agroforestasi
- Kelapa agroforestasi
- Pinang agroforestasi
- Kebun campuran
- Bambu
- Semak belukar
- Padang rumput
- Sawah/padi
- Jagung
- Tebu
- Pertanian lahan kering lainnya
- Pemukiman
- Lahan terbuka
- Tambak
- Badan air
- Danau



Peta Intervensi

Provinsi Nusa Tenggara Timur

Menuju Pertumbuhan Ekonomi Hijau

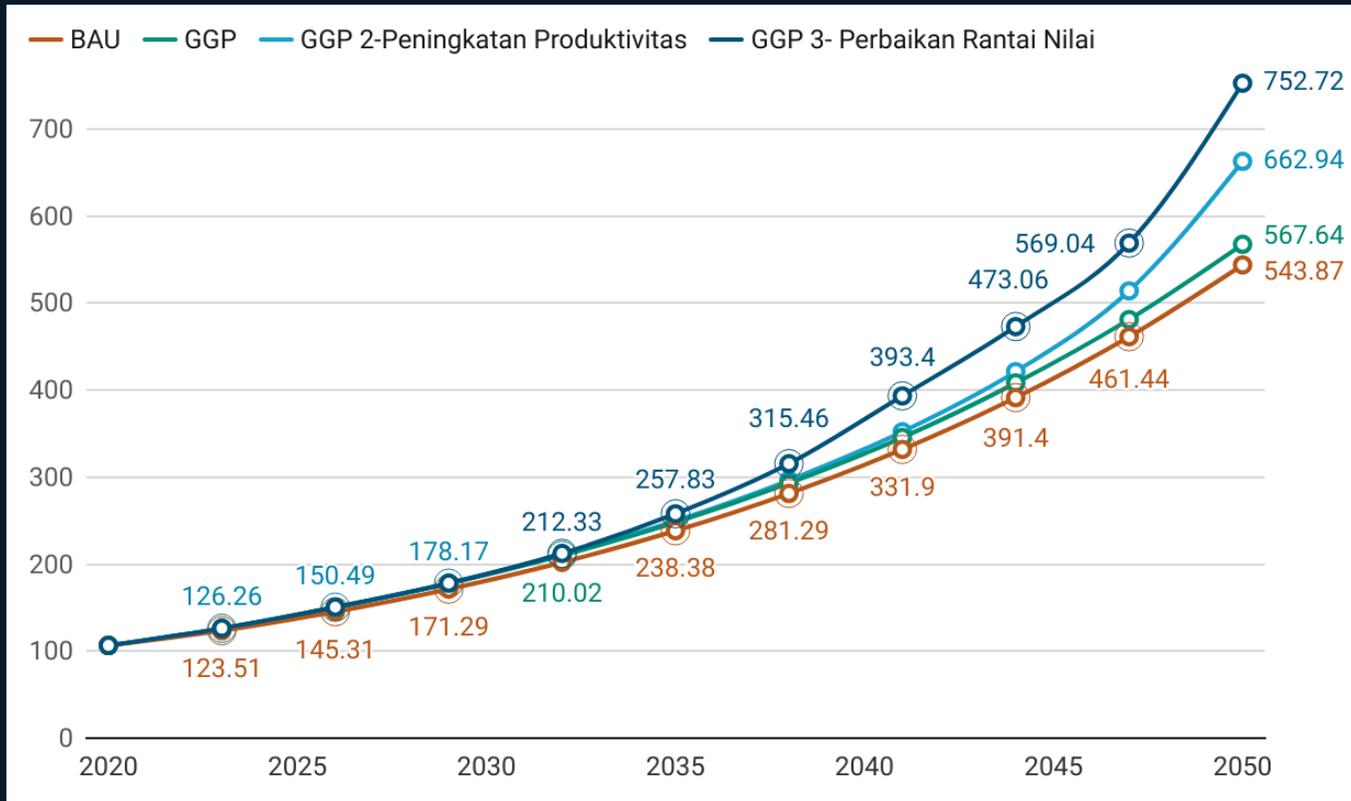


1. Alokasi perlindungan hutan terutama untuk area konservasi dan kawasan lindung.
2. Perlindungan area sempadan sungai, badan air dan pesisir.
3. Rehabilitasi DAS kritis dengan sistem agroforestri.
4. Optimalisasi lahan perhutan sosial dengan pengembangan agroforestri berbasis masyarakat.
5. Alokasi revitalisasi/peremajaan jambu mete, kopi, kelapa, kemiri dan kakao berbasis agroforestri.
6. Alokasi pengembangan tanaman pangan (padi dan jagung) pada kesesuaian lahan yang tepat.
7. Penerapan intensifikasi pertanian pertanian berkelanjutan/Good Agricultural Practices (GAP) berbasis komoditas lokal

Legend

Tidak ada intervensi	Intervensi 4	Intervensi 5 - Kemiri
Intervensi 1	Intervensi 5 - Jambu mete	Intervensi 5 - Kakao
Intervensi 2	Intervensi 5 - Kopi	Intervensi 6 - Padi
Intervensi 3	Intervensi 5 - Kelapa	Intervensi 6 - Jagung
		Intervensi 7

Proyeksi Indikator Ekonomi Regional Pertumbuhan PDRB

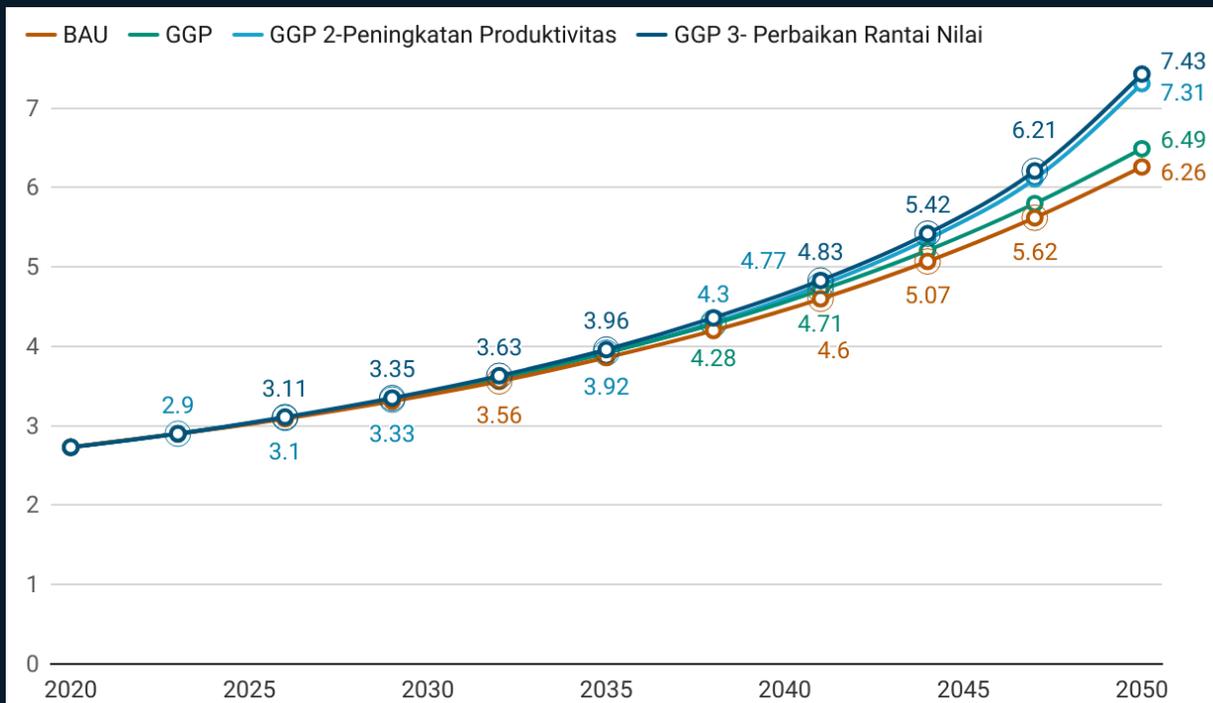


Pada tahun 2050, PDRB dalam skenario GGP diperkirakan mencapai **Rp 752,72 triliun, lebih tinggi dibanding BAU**. Setelah periode awal (2020–2023) dengan pertumbuhan rata-rata **5,3%-6%** per tahun hingga 2050.

Peningkatan produktivitas komoditas unggulan menjadi kunci pertumbuhan yang lebih tinggi dari sektor ekonomi terbarukan berbasis lahan

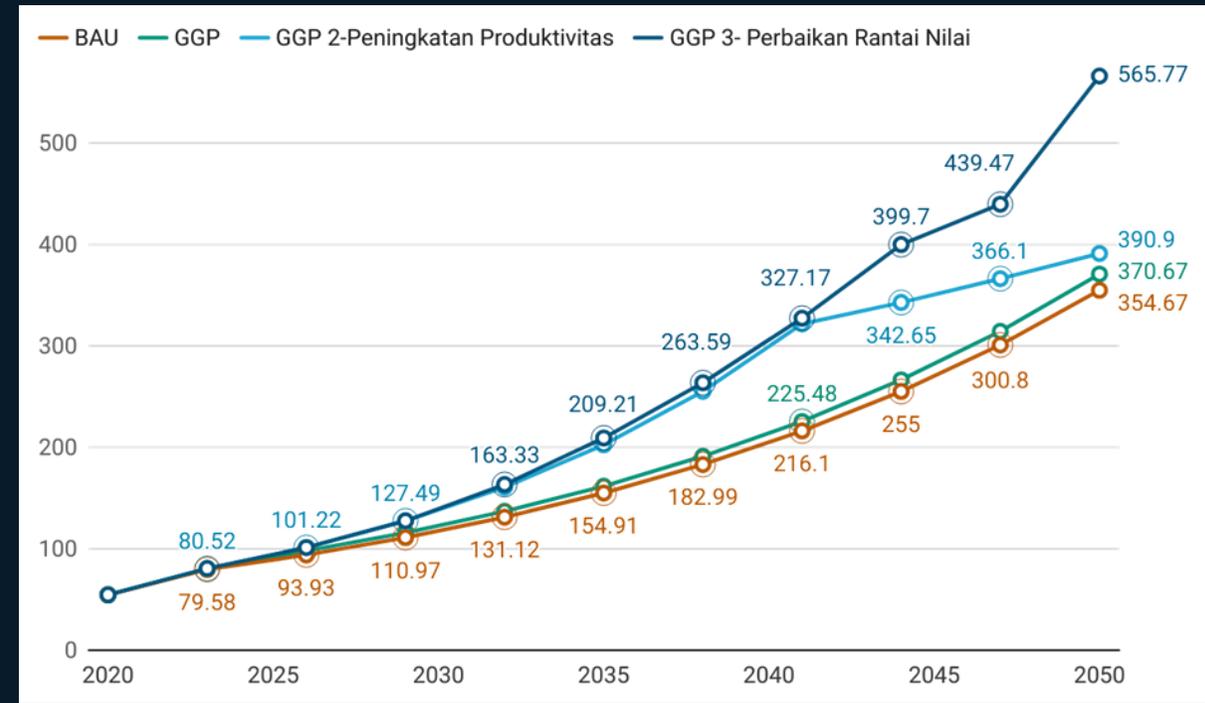
Proyeksi Indikator Ekonomi Regional

Serapan tenaga kerja



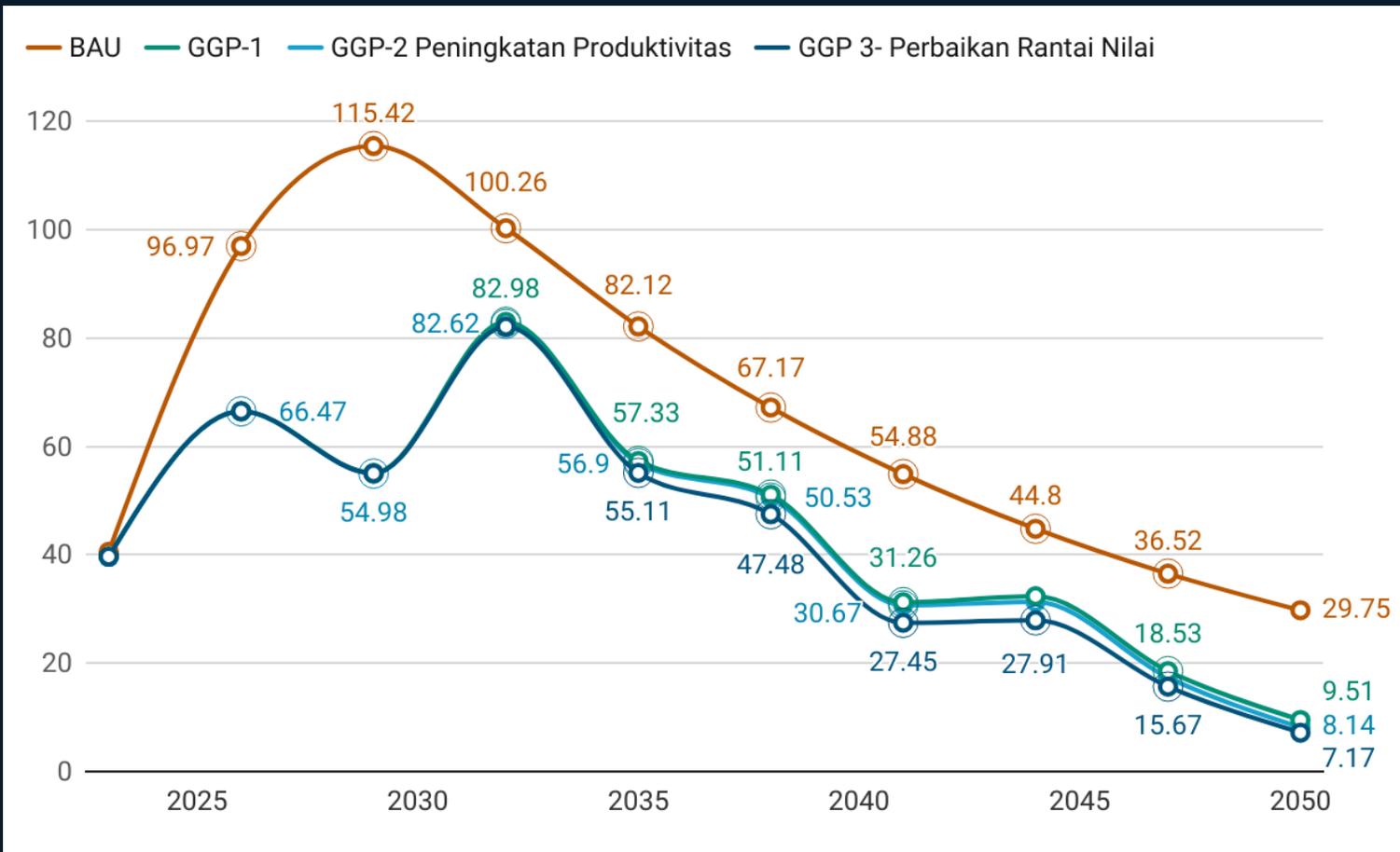
Skenario GGP-3 diproyeksikan akan **meningkatkan serapan tenaga kerja menjadi 7,42 juta jiwa pada tahun 2050.**

Pendapatan



Pada skenario GGP-2 dan GGP-3 diproyeksikan adanya **total peningkatan pendapatan tenaga kerja hingga 75%-80% pada 2038-2050.**

Proyeksi Intensitas Emisi Gas Rumah Kaca (GRK) Dari Sektor Lahan



Pada awal simulasi, intensitas emisi mencapai angka 40,53 ton CO₂-eq/Miliar Rupiah.

Intensitas emisi skenario BAU pada tahun 2050 menunjukkan angka 29,75 ton CO₂-eq/Miliar Rupiah. Sedangkan pada skenario GGP hilirisasi intensitas emisi menunjukkan nilai yang jauh lebih rendah sebesar 7,17 ton CO₂-eq/Miliar Rupiah.

Pengaplikasian dan Pencapaian LUMENS

- ICRAF telah berhasil mendampingi 5 provinsi (Aceh, Jambi, Sumatera Selatan, Papua Barat, dan Papua) di 2 pulau besar di Indonesia dan satu provinsi (Lampung) di Vietnam untuk mengembangkan rencana pembangunan regional berbasis ekonomi hijau dari sektor lahan terbarukan.
- Dokumen tersebut turut mendukung praktik agroforestri sebagai strategi pengelolaan lanskap melalui pendekatan antar sektor yang inklusif, integratif, dan informatif.
- Rencana ekonomi hijau dapat diurutkan untuk mendukung perencanaan pembangunan sub-nasional, alat investasi untuk sektor swasta, melalui pendekatan yurisdiksi dan pemantauan berkelanjutan.



Bagaimana anda dapat ikut serta?



Pemanfaatan dalam Praktik

- Mengujicoba LUMENS dalam pekerjaan masing-masing
- Menggunakan LUMENS untuk membantu menganalisis sebuah penelitian tugas akhir dan publikasi

Kontribusi Dokumentasi dan Edukasi

- Berkontribusi dalam menuliskan studi kasus sebuah modul LUMENS
- Menggunakan LUMENS untuk membantu proses belajar dan pengembangan bahan ajar. Menyusun tutorial panduan pengguna dalam berbagai media (misal: video tutorial, blog, diktat praktikum, dsb.)
- Diskusi dua arah melalui forum *E-learning* LUMENS

Kontribusi Teknis

- Ikut mengembangkan kode LUMENS melalui GitHub, misalnya dengan membuat *pull request*, melaporkan bug, atau mengusulkan fitur baru

LUMENS Code Repository



Pengembangan LUMENS berbasis *open-source*: kode sumber tersedia secara terbuka untuk dikembangkan bersama kontributor.

Kunjungi laman github LUMENS pada tautan berikut:

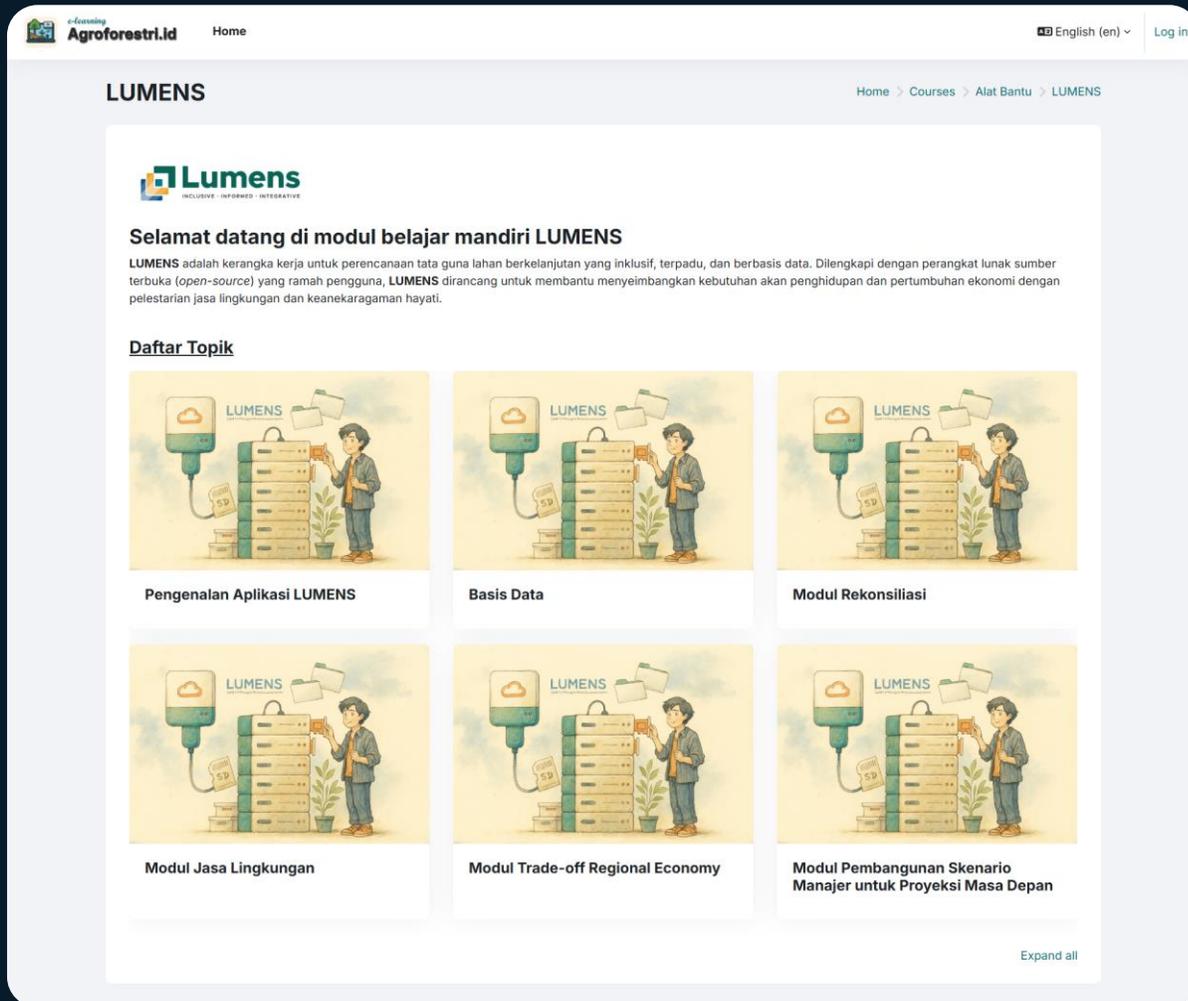
<https://github.com/icraf-indonesia/lumens-shiny>



The screenshot shows the GitHub repository page for 'lumens-shiny'. The repository is public and has 20 branches and 5 tags. The main branch is 'main'. The repository has 3166365 files, 442 commits, and 0 stars. The repository is described as 'Development LUMENS into Shiny version'. The repository has 4 releases, with the latest being v2.0.1 on Oct 18, 2024. There are 3 packages published. The repository has 5 contributors. The repository is written in R.

Commit	Description	Time
fazamahezs	add function to read and convert xlsx tpm format into long format, so...	3166365 · last week
01_pur1	convert PUR modules file structure into 'app.R' version	5 months ago
02_pur2	convert PUR modules file structure into 'app.R' version	5 months ago
03_preques	solve issue #50 and disable color_landuse_trajectories() in pr...	last week
04_quesc	fix incorrect units	last week
05_quesb	Change the GIF to MP4 format on each module	6 months ago
06_quesh	move tutorial video from helpfile folder to www folder	4 months ago
07_ta-profit	Change the GIF to MP4 format on each module	6 months ago
08_ta-regional1	Change the GIF to MP4 format on each module	6 months ago
09_ta-regional2	Change the GIF to MP4 format on each module	6 months ago
10_sciendo-scenario	update report	2 months ago
11_sciendo-simulate	add function to read and convert xlsx tpm format into long ...	last week
11_sciendo-train	resolve issue #83	2 months ago
12_lasem	Add a favicon to each modules	10 months ago
data	remove txt files	2 months ago
tests/testthat	Solves #54	last month
www	Add rendered html to the docs	10 months ago

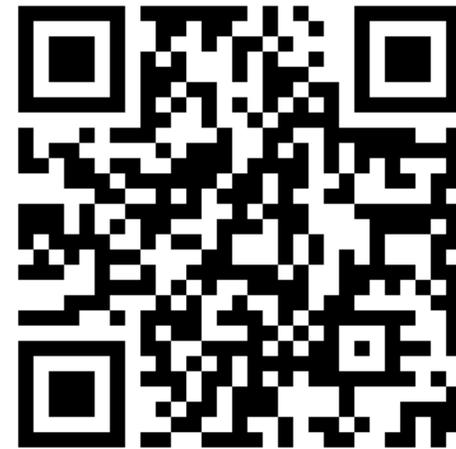
LUMENS E-Learning



The screenshot shows the LUMENS E-Learning website. At the top left is the logo for 'Agroforestri.id' with 'Home' next to it. At the top right, there is a language selector set to 'English (en)' and a 'Log in' button. Below the header, the page title 'LUMENS' is displayed, followed by a breadcrumb trail: 'Home > Courses > Alat Bantu > LUMENS'. The main content area features the LUMENS logo with the tagline 'INCLUSIVE - INFORMED - INTEGRATIVE'. Below the logo is a welcome message: 'Selamat datang di modul belajar mandiri LUMENS'. A paragraph follows, describing LUMENS as an open-source framework for sustainable land use planning. Underneath is a 'Daftar Topik' (Topic List) section with six cards, each featuring an illustration of a person with a stack of books and a plant. The topics are: 'Pengenalan Aplikasi LUMENS', 'Basis Data', 'Modul Rekonsiliasi', 'Modul Jasa Lingkungan', 'Modul Trade-off Regional Economy', and 'Modul Pembangunan Skenario Manajer untuk Proyeksi Masa Depan'. At the bottom right of the topic list is an 'Expand all' link.

Pembelajaran mengenai LUMENS dapat mengunjungi: <https://lumens.or.id> > klik menu **Sumber Daya** > klik submenu **E-learning**

<https://agroforestri.id/elearningLUMENS>



Referensi

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Terima Kasih

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Website : lumens.or.id
Repositori GitHub : github.com/icraf-indonesia/lumens-shiny

