

Land cover and land accounting in Vanuatu

Training and technical assistance on land cover estimation using EO data and land accounts compilation

31 March – 4 April 2025

ESCAP project on Big Data for Official Statistics

- ‘The 2030 Data Decade - Strengthening the institutional capacity of national statistical offices in Asia and the Pacific to use innovative, new and big data sources for official statistics in support of the 2030 Agenda for Sustainable Development’
 - Funded by UN Peace & Development Trust Fund (UNPDF)
 - 1st April 2023 - 31st March 2025
 - 20 beneficiary countries across the region, with in-depth technical assistance in 4 target countries

Big Data Project – Outcome & Activities

Increase institutional capacity of participating NSOs to use innovative, new and big data sources for official statistics.

Direct support to target countries

Practical guides on use of big data

Thematic and Regional Workshops

Reports sharing experiences and best practice from across region & beyond

Sharing experiences at international and regional dialogues

Beneficiary countries

- North & Central Asia:
 - Azerbaijan
 - Kazakhstan
 - Kyrgyzstan
 - Tajikistan
 - Uzbekistan
- East & North-East Asia:
 - Mongolia
- South & South-West Asia:
 - Bangladesh
 - Maldives
 - Nepal
- South-East Asia:
 - Cambodia
 - Indonesia
 - Lao PDR
 - Malaysia
 - Thailand
 - Timor-Leste
- Pacific:
 - Fiji
 - Kiribati
 - Papua New Guinea
 - Tonga
 - Vanuatu

Direct support to target countries

Focus on usable
solutions for
Official Statistics

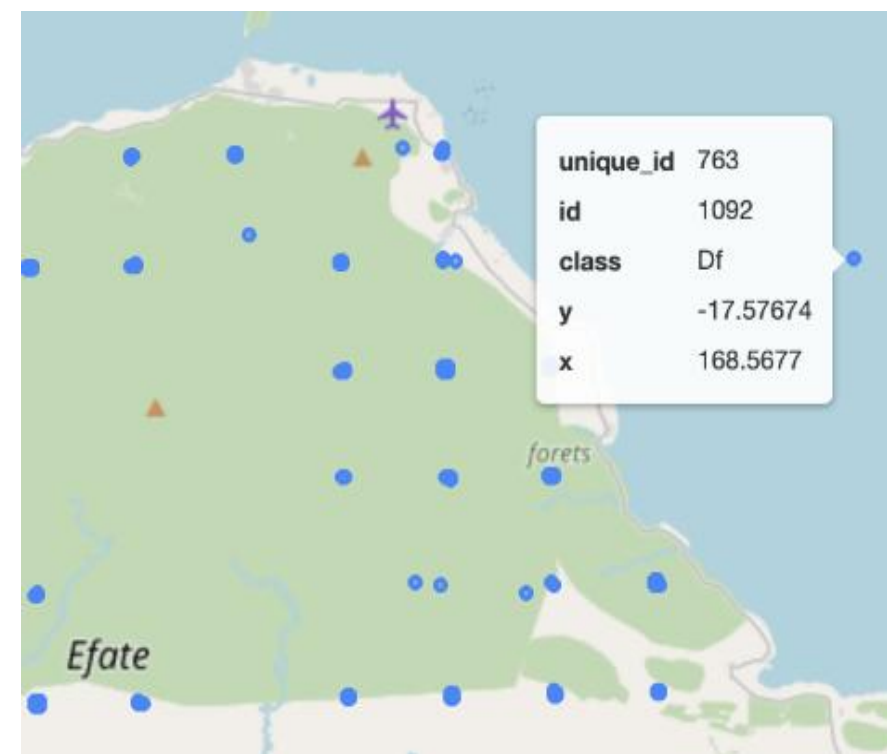
Priorities identified
by national users

Partnership based
working

- Support for 4 countries in incorporating use of big data into their official statistics
 - Identified through Expression of Interest process
 - Focus on moving beyond experimentation towards regular statistical production
- Combination of in-person workshops and technical assistance, along with ongoing remote support

Progress to date: Project initiation in Vanuatu

- In-country activities initiated during mission **5-7 December**
 - Consultation with stakeholders: Met with experts from 8 ministries/departments & Parliament to discuss policy priorities, associated data needs and the role that geospatial data can play
 - Agreed initial focus on land accounting, building on work conducted by Radiant Earth using forest inventory if possible
 - Completion of initial training session on land accounting concepts and methods

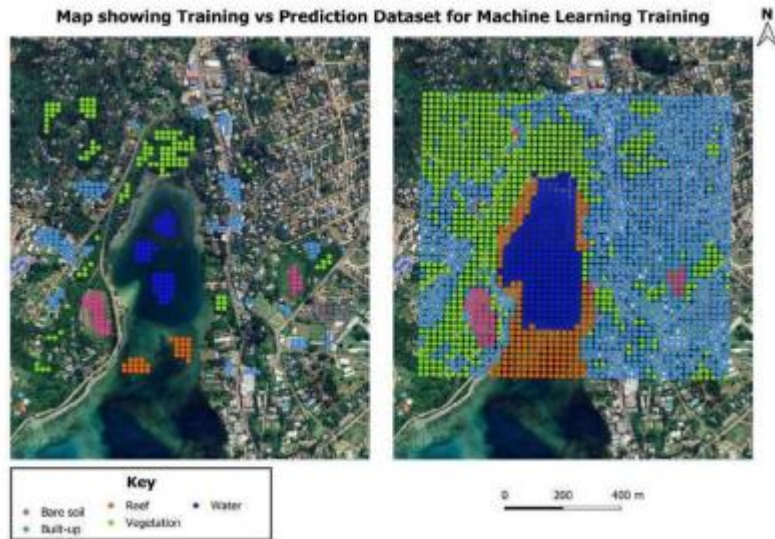


Progress to date: Technical training on data science & machine learning



- In-person training provided by ESCAP SD and SIAP from 15-26 April 2024, including the following foundational components:
 - Introduction to Data Science for Official Statistics and the SDGs
 - Machine Learning fundamentals
 - Data visualization
 - Introduction to Geographic Information Systems (GIS)

Progress to Date: Training and technical assistance on QGIS and land accounts compilation



- July 2024: Hands-on practical sessions on the end-to-end production of a land account for a small accounting area in Vanuatu using QGIS and R
 - Satellite imagery acquisition,
 - Creation of a reference dataset consisting of land cover class samples
 - Generation of the dataset for model training
 - Development of a random forest model for land cover classification
 - Transformations and adjustments of the resulting land cover data for the opening and closing periods
 - Compilation and interpretation of the land account



This week: Training and technical assistance on land cover estimation using EO data and land accounts compilation

- Building on previous training, focused on the development and implementation of an enhanced workflow for land cover mapping and land account compilation
 - Following the PAELA (Pipeline for Agile Estimation of Land Accounts) approach introduced during the remote support in November 2024
 - Approach introduced in July 2024 will also be expanded upon through the use of an expanded land cover classification in line with identified user needs.
 - PAELA workflow is designed to support automation (using R/Python/PyQGIS) where possible alongside expert knowledge and interpretation where required.

What is the System of Environmental-Economic Accounting?

- SEEA is a framework that integrates economic and environmental data to provide a comprehensive & multipurpose view of the interrelationships between the economy & the environment, and the stocks and changes in stocks of environmental assets, as they bring benefits to humanity.
 - Contains internationally agreed standard concepts, definitions, classifications, accounting rules & tables for producing internationally comparable statistics & accounts
 - Follows a similar accounting structure to the System of National Accounts (SNA)
 - Multipurpose – generates a wide range of statistics and indicators with many different purposes
 - Flexible – can be adapted to countries priorities and policy needs

What is Land Accounting?

- *Land is a unique environmental **asset** that delineates the space in which economic activities and environmental processes take place and within which environmental assets and economic assets are located.* (SEEA-CF Sections 5.62, p. 174)
- Land Accounts measures the area of coverage of defined land types
 - Land cover (terrestrial, freshwater, coastal and marine areas)
 - Land use, ownership (optional)
- Inter-institutional **agreement** on what exists on national land and water

Land cover or land use?

Land cover

Physical and biological surface features

Often misinterpreted or combined with land use

e.g. forestry, agriculture, urban

Land use

Social or economic function

“Forestry” lands many have no trees

“Agriculture” lands may have no crops

“Urban” areas may have grasslands

Resource departments (forestry, agriculture, environment) often record **“designated use”**: may not agree with land cover assessments

* Designated use (what it should be used for) maybe different from actual use

Agree on land cover first!

Compare with resource departments on “use”

Will also help resolve “ownership” issues

Why Land Accounting?

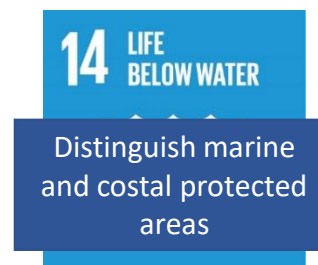
- Spatial foundation for all national administrative data and policies
- Land & resource management, conservation policies, land tenure
- Climate change: land use change → climate; climate → land cover
- Links to SEEA-CF (Forest, Soil); SEEA-Agriculture, Fisheries & Forests
- Foundation for SEEA-EEA (Ecosystem Accounting)
- Indicators:
 - Land cover change → where are changes occurring?
 - Land cover by land use → who manages it?

Land accounts support many SDGs

Land cover & change



Land use

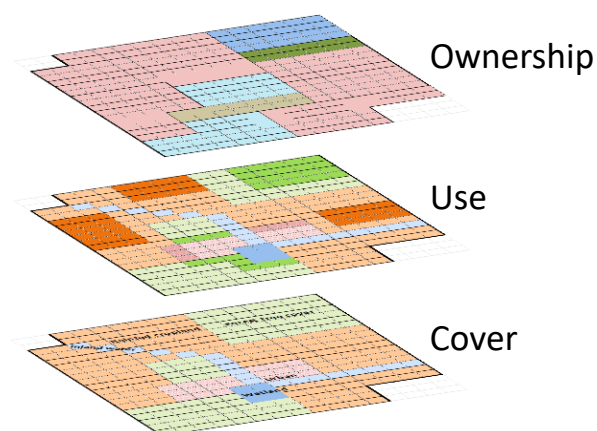


Land ownership

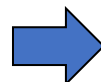


What does a Land Account look like?

Maps



Many data sources



Tables

Table 5.13
Physical account for land cover (hectares)

	Artificial surfaces	Crops	Grassland	Tree-covered area	Mangroves	Shrub-covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and inland water bodies	Coastal water and inter-tidal areas
Opening stock of resources	12 292.5	445 431.0	106 180.5	338 514.0	214.5	66 475.5	73.5	1 966.5		12 949.5	19 351.5
Additions to stock											
Managed expansion	183.0	9 357.0									
Natural expansion			64.5								1.5
Upward reappraisals			4.5								
Total additions to stock	183.0	9 357.0	69.0								1.5
Reductions in stock											
Managed regression		147.0	4 704.0	3 118.5	9.0	1 560.0	1.5				
Natural regression					1.5	64.5					
Downward reappraisals						4.5					
Total reductions in stock		147.0	4 704.0	3 118.5	10.5	1 629.0	1.5				
Closing stock	12 475.5	454 641.0	101 545.5	335 395.5	204.0	64 846.5	72.0	1 966.5		12 949.5	19 353.0

Note: Crops include herbaceous crops, woody crops, and multiple or layered crops.



Classifications

What does a Land Account look like?

- An integrated spatial (GIS) database that overlays:
 - Land cover (including water)
 - Use and intensity of use (optional)
 - Ownership (optional)
- For two or more periods (to compare)
- Based on comparable: classifications, quality and methods
- Units: hectares
- Output tables:
 - Opening stock
 - + Additions
 - Reductions
 - = Closing stock

What do you need to compile a Land Account?

- GIS platform: Software, protocols (e.g., standard projection)
- **Classifications**: Land cover, land use, ownership
- Land cover data
 - Satellite, aerial photography, field research
 - Hydrological, topographic (rivers, drainage areas, elevation, coastlines)
- Land use data (optional)
 - Agriculture, population census, administrative, forest inventories
- Ownership data (optional)
 - **Cadastral** (ownership, tenure, zoning, tax, price)
- Expertise
 - Land managers (forestry, agriculture, lands...),
 - Geographers (GIS, satellite imagery, integration)
 - Statisticians (classifications, accounts)

Think Spatially: maps to data to accounts



What you see...

- Many kinds of “Tree covered areas”
- Many kinds of “Artificial Surfaces”

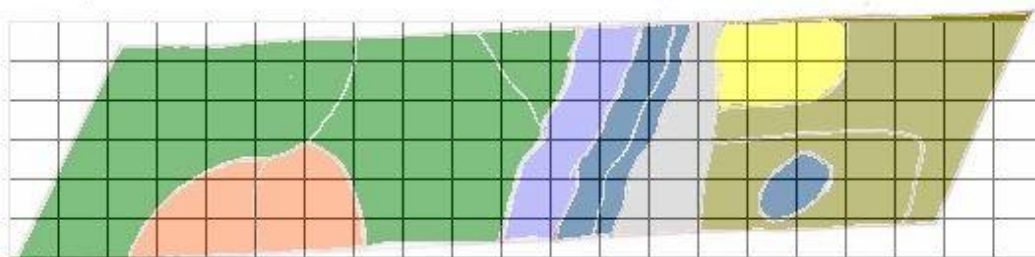
Is simplified into
classes... (vector)






Think Spatially: maps to data to accounts



What you see...

and generalized to a
grid (raster)



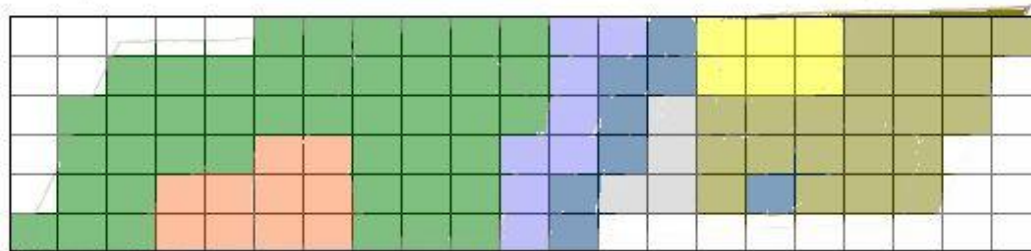
	LEGEND
	Artificial Surfaces
	Crops
	Grassland
	Tree covered areas
	Regularly flooded
	Inland waters
	Barren land





Think Spatially: maps to data to accounts



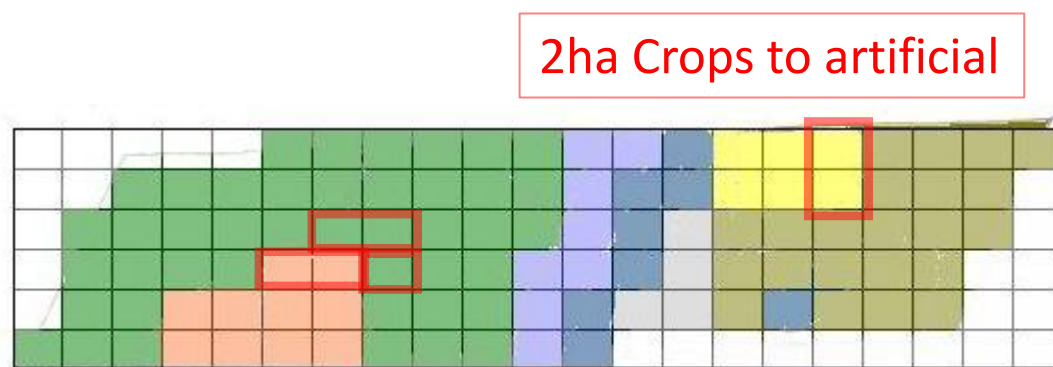
What you see...

...where cell value is
“predominant” land
cover type

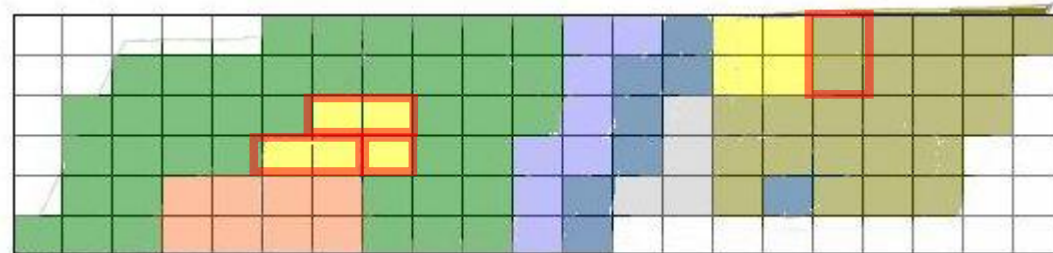


	LEGEND
	Artificial Surfaces
	Crops
	Grassland
	Tree covered areas
	Regularly flooded
	Inland waters
	Barren land

Land cover change



Now we can compare
the two!



What has changed?

	LEGEND
olive green	Artificial Surfaces
yellow	Crops
orange	Grassland
green	Tree covered areas
light blue	Regularly flooded
dark blue	Inland waters
grey	Barren land

2ha Grassland to crops

3ha Tree covered to crops

Land cover change matrix

Table 5.14
Land cover change matrix (*hectares*)

Land cover	Increases (positive numbers) and decreases (negative numbers) from other land covers												Net change (increase-decrease)	Closing area
	Opening area	Artificial surfaces	Crops	Grassland	Tree-covered area	Mangroves	Shrub-covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and inland water bodies	Coastal water and intertidal areas		
Artificial surfaces	12 292.5		147.0	27.0		9.0							183.0	12 475.5
Crops	445 431.0	-147.0		4 677.0	3 118.5		1 560.0	1.5					9 210.0	454 641.0
Grassland	106 180.5	-27.0	-4 677.0				69.0						-4 635.0	101 545.5
Tree-covered area	338 514.0		-3 118.5										-3 118.5	335 395.5
Mangroves	214.5	-9.0										-1.5	-10.5	204.0
Shrub-covered area	66 475.5		-1 560.0	-69.0									-1 629.0	64 846.5
Regularly flooded areas	73.5		-1.5										-1.5	72.0
Sparse natural vegetated areas	1 966.5													1 966.5
Terrestrial barren land														
Permanent snow, glaciers and inland water bodies	12 949.5													12 949.5
Coastal water and intertidal areas	19 351.5					1.5							1.5	19 353.0

Note: Including herbaceous crops, woody crops and multiple or layered crops.

Physical account for land cover

Table 5.13
Physical account for land cover (*hectares*)

	Artificial surfaces	Crops	Grassland	Tree- covered area	Mangroves	Shrub- covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and inland water bodies	Coastal water and inter-tidal areas
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Note: Crops include herbaceous crops, woody crops, and multiple or layered crops.

Scope and definitions (Table 5.13)

- Scope: The land area, inland waters & coastal areas of a country (includes estimation – not directly from data)
- **Managed expansion/regression:** a change in the area of a land cover type due to human activity. [matching entry]
- **Natural expansion/regression:** a change in area resulting from natural processes. [matching entry]
- A matching entry is not recorded if there is a change in the total land area.
- **Reappraisals (upward or downward):** changes due to updated information on the area of different land covers.

Related accounts

- Table 5.15 Physical asset account for forest and other wooded land
- Table 5.16 Monetary asset account for land (currency units)
- Table 5.17 Physical asset account for area of soil resources (hectares)
- Table 5.18 Physical asset account for volume of soil resources (cubic meters)
- Table 5.19 Physical asset account for timber resources (thousands of cubic metres over bark)
- Table 5.20 Monetary asset account for timber resources (currency units)

Take home points

- Land Cover maps, classified by the SEEA-CF classification are a useful starting point for creating a Land Account
- Data need to be national and comparable
- Combine satellite data with other data
- An interdepartmental team should agree on “One Map”
- Always consider land cover first before land use

THANK YOU

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