ESCAP Regional Expert Workshop on Land Accounting for SDG Monitoring and Reporting
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1. Background

The surface of the earth: the land, freshwater, coasts and oceans, is the space in which most human activities take place. As with business and population registers, coherent and agreed-upon statistics on what exists on the surface of a nation is fundamental to governing and managing it. Land accounting seeks to standardize and integrate the spatial aspects of environmental, social and economic statistics to provide such a foundation.

Monitoring progress towards the 2030 Agenda for Sustainable Development demands spatially-detailed statistics across many dimensions: for disaggregating statistics by urban/rural, for distinguishing areas with access to clean water and roads, for distinguishing catchment, marine & coastal, forest, agricultural, mountain and protected areas, for distinguishing degraded areas and establishing land tenure, just to mention a few.

Statistically describing a nation's biophysical area is treated in the SEEA Central Framework (SEEA-CF) in terms of Land, Forest and Soil Asset Accounts. It is also described in the FDES (United Nations Statistics Division, 2013) as key statistics on land cover, land use, ecosystems and biodiversity. The SEEA Experimental Ecosystem Accounting guidelines (SEEA-EEA, United Nations *et al*., 2014b) provide further guidance on delineating ecosystem assets, compiling information on their condition, the values of their ecosystem services and linking these values to standard economic accounts. The UN initiative on Global Geospatial Information Management (UN-GGIM) knowledge base on National Spatial Data Infrastructure (NSDI)[1] highlights the experience of countries in integrating such spatial information.

Although many countries have been compiling information on their land, few have experience in integrating and standardizing this information from the many sources and methods used. Integrating this disparate information, through land accounting, is essential to provide a comprehensive picture of the environmental state of a country and to guide plans to improve or maintain this state.

Traditionally, producing land information has not been the core mandate of National Statistical Offices (NSOs). However, for at least 30 years, many NSOs have developed the capacity to conduct spatial analysis and to standardize and integrate land data from many sources. This has required close collaboration with national stakeholders such as departments of environment, natural resources, fisheries, oceans, agriculture, forestry, planning, and land registration. The benefit of including NSOs in this process has been their role as a broker between the different departmental mandates, disciplines and standards.

ESCAP, in collaboration with partners, have been providing technical assistance and training on environment statistics and environmental-economic accounting to countries individually and through sub-regional workshops. In all sub-regional workshops, participants presented self-assessments of priorities for strengthening environment statistics. Several countries identified land accounts as priorities. Work is in progress in Nepal, Vanuatu, Myanmar (with the World Wildlife Fund) specifically on piloting land and forest accounts, and in Indonesia on land and ecosystem accounts. In this regard, there have been demands from countries for technical guidance on how to begin or improve their land accounts.

[1] National Spatial Data Infrastructure, see: http://ggim.un.org/knowledgebase/KnowledgebaseCategory3.aspx.

The Regional Expert Workshop on Land Accounting for SDG Monitoring and Reporting is a response to these needs under a global capacity development programme,[2] which works to improve national statistical capacity for measuring and monitoring the 2030 Agenda for Sustainable Development. Pillar 2 of the programme focuses on strengthening capacity in developing countries to measure and monitor sustainable development goal indicators in environment statistics areas. The expected outcomes are strengthened capacity in developing countries to measure and monitor indicators and targets in new statistical and data areas, and enhanced leveraging, partnerships and collaboration by United Nations system and other partners to help countries strengthen their national statistical systems for measuring the sustainable development goals.

2. Purpose of the workshop

The overall aim of the workshop was to address member States' stated requirements for technical guidance on how to begin or improve their land accounts.

The 3-day workshop brought together NSOs and natural resource departments with regional and international experts. The workshop consisted of four main components:

1. Case studies by member States' activities in land, forest and ecosystem accounting, including presentation of objectives, approaches, results and remaining challenges;
2. Focussed training on aspects identified by participants (including links to SDGs, NSDI, forest accounting, ecosystems and oceans);
3. Guided technical assistance and problem-solving labs with regional experts, and
4. Reports on related initiatives and support by international organizations

Member States which had initiated or had expressed their readiness to initiate land, forest or ecosystem accounts were invited. Two participants from each selected country were nominated: one from the NSO and another from a natural resources department, both of whom were responsible for producing land statistics.

Participants were requested to make a short presentation on their priorities, status of work, challenges of land statistics. If work was in progress, they were invited to bring their data (in GIS, maps and tables) for detailed discussion during the technical assistance and problem-solving labs.

3. Workshop results

3.1 Participation

Thirty eight participants from fifteen countries in Asia and the Pacific participated (China, Fiji, India, Indonesia, Iran, the Maldives, Myanmar, Nepal, the Philippines, the Russian Federation, Sri Lanka, Thailand, Timor-Leste, Vanuatu and Viet Nam). Staff from ESCAP Pacific Office (EPO), ESCAP Information and Communications Technology and Disaster Risk Reduction Division (IDD), ESCAP Environment and Development Division (EDD), UN Environment Poverty Environment Initiative, UNDP (REDD+), as well as experts from Canada, the Netherlands and the Asian Institute for Technology participated.

3.2 Country status

A major factor in determining a country's readiness in terms of land accounting is related to the state of spatial data holdings used. Some countries who participated in the workshop have well-established, detailed spatial frameworks, policies to deal with spatial data and follow established classifications such as the SEEA land cover and land use classifications. All these components help to establish a robust land accounts.

[2] The United Nations Development Account, 10th Tranche: Programme on Statistics and Data

One of the most important aspects in beginning land accounts is that a central repository or spatial database for managing spatial data is established. Taking the time to discover spatial data and determine which spatial datasets to include are important considerations. During the workshop it was apparent that most of the countries relied on other departments or stakeholders to supply the spatial data inputs into their land accounting project. Therefore, it was underscored during the workshop that coordination and collaboration among different departments and stakeholders was vital in initiating and/or improving land accounts.

Participating countries recognised that land cover derived from satellite imagery is an essential component of a land account and forms one of the base spatial data inputs. Countries that were using satellite imagery 30-metre data had detailed land cover or land use classifications they followed. Also, a recurring theme identified in the workshop was the need for a consistent referencing system or shoreline. A good shoreline is important, as it provides the base for the opening and closing of the total land area for a country. Some countries have already focused on using a single common shoreline for their overall spatial data. While others identified how the lack of a common standard spatial datasets created issues in compiling land accounts.

Due to lack of spatial data and/or limitations on technical capacity, some countries were at different stages of development of their land accounts. These countries as well as others could benefit from some of the global land cover and spatial datasets available from data providers. These are discussed further below.

Canada: Canada has implemented Land Accounts, coordinated by Statistics Canada, for over 20 years. The accounts now include coherent a spatial data infrastructure, data on cover, use, potential and value. Challenges that have been met in the past include collaboration among stakeholders and data quality. The accounts were a value-added to data providers by offering consistent methodology, concepts, classifications and processes over time. This allows for comparison over time. The accounts are now used as the basis for analytical work on land use change, environmental assessments and harmonizing approaches to ecosystem accounting.

At the start of its Land Accounts program, Canada used the 250-metre land cover time series from Natural Resources Canada (NRCAN) as its base. The NRCAN land cover data is based on the MODIS package found on NASA's Terra satellite. Over time other spatial datasets such as, terrestrial ecoregion boundaries, digital elevation models, water features from the national topographic map series (1:50 000), soils and climatic data and socio-economic data from the censuses of population have been integrated and added to the MODIS 250m land cover data. This has led to the creation of comprehensive national spatial geodatabase for land accounts.

The benefit of acquiring these other spatial databases was that they provided a method to validate and replace the original MODIS land cover data. If it was deemed that the newer spatial datasets provided a more accurate representation of the original MODIS land cover, the MODIS data was replaced with the more accurate spatial data source. This in turn led to better accuracy in terms of land cover areas and provided the opportunity to develop land indicators such as land fragmentation and improved population densities.

China: The objective of China's Natural Resources Accounting program, a collaboration between the National Bureau of Statistics, the Ministry of Water Resources and the State Forestry Administration, is to realize China's vision of an eco-civilization and to integrate resource consumption, environment damage, and ecological benefits into the economic and social development valuation systems. Current priorities are to develop accounts for land, forests and water. The forest accounting work has resulted in a theoretical framework for forest accounts, accounts for forest land and timber (monetary and physical), and monetary values of forest ecosystem services. Challenges that were overcome in producing these included absence of detailed valuation methods and inconsistent data on land cover classifications between departments.

Currently a 30-metre land cover product (GlobeLand30 http://www.globallandcover.com) covering 2 periods (2000 and 2010) has been created by the National Geomatics Center of China, using Landsat imagery. This land cover product is the largest in terms of spatial extent in that it covers most areas of the globe. If adopted this dataset could be used to overcome the inconsistency in land cover classifications by Chinese departments.

Fiji: Fiji's environmental concerns that could be addressed through land accounting include: competing land use, declining agriculture and increasing concentrations of coastal population and infrastructure. This all raises the risk of impacts of climate change and natural disasters. Under the Fiji Land Use Development plan, spatial data are integrated, by the Ministry of Lands and Mineral Resources and shared via an online portal (http://www.lands.gov.fj/index.php/department/department-of-lands/corporate-service-5). The Fiji Bureau of Statistics (FBoS) is the custodian of official statistics and plans to develop land accounts to support the validation and analysis of land cover and value data. Challenges to completing land accounts include: lack of historical digital data, standardization of concepts and classifications across the NSS, capacity to analyse spatial data across the NSS, and lack of data sharing arrangements. Work is currently progressing on collecting and validating existing data.

India: While India has been collecting and compiling detailed land data, it has only recently started integrating spatial data from various sources to compile national trial accounts. To accomplish this, data collection systems from different ministries and states will require reorientation. Compilations using existing classifications show substantial increases in forest area and cropland since the 1950s. At the same time, barren and other lands have decreased. The objective of The Digital India Land Records Modernization Programme (DILRMP) is to develop a transparent land records management system including a titling system to record ownership. This is essential to managing land tenure as well as credit support, crop compensation, disaster management and integrating spatial from various sources (soil survey, forest survey). The role of the NSO is to support this by providing guidance on standards and quality.

Indonesia: Indonesia's Ministry of the Environment and Forestry (KLHK, http://geoportal.menlhk.go.id/arcgis/home/) has collaborated with Statistics Indonesia (BPS) to develop pilot Land Accounts. This is part of the One Map (2015-2019) plan to integrate sectoral and thematic spatial data (http://portal.ina-sdi.or.id/home/). Challenges addressed include access to data, appropriate methods, consistency over time and accuracy of the data. The Land Accounting approach has added value to existing spatial data by providing a coherent approach to analysing changes. Initial policy applications are monitoring deforestation and emissions from land use change. The accounts are expected to support further work on ecosystem accounting.

Indonesia is using 1:50 000 scale spatial data which provides a very good detailed spatial framework for land accounts. Coupled with Landsat 30 metre and SPOT satellite data, Indonesia has been able to develop a land cover time series from 1990 – 2016. By integrating provincial administrative boundaries into the spatial database, Indonesia has a method of reporting land cover and land use data at a smaller spatial level.

Iran: The Statistics Centre of Iran is collaborating with ministries of energy, environment and agriculture to develop environmental accounts. The initial focus is on water and waste. The challenges to accomplish this include coordination and collaboration among departments as well shared technical capacity across departments. Developing capacity for environmental accounting is expected to contribute to the IRANSTARS (Iran Statistical Register System), which will maintain a databank of administrative data.

By engaging with other federal Iranian ministries and inventorying their data spatial data holdings an integrated and standardised land accounts spatial dataset can be developed.

The Maldives: The Maldives are challenged with coastal erosion, tidal waves, loss of mangroves, scarcity of vacant land, water salination, groundwater contamination and land reclamation. The Maldives Land and Survey Authority (MLSA) under the Ministry of Housing and Infrastructure has the mandate to manage the country's land use. The key role of the National Bureau of Statistics will be to coordinate the development of a core set of land statistics, including those derived from land accounts. One challenge in digitizing available data is that much is derived from island councils, which use different standards. Although the Maldives have developed an NSDI, the MLSA is the only agency with the capacity to analyse spatial data. Results of the Land Information System are published on http://onemap.mv. There is still a need to establish a Geodetic Referencing System, strengthen land laws and registration, improve georeferencing of data collected and strengthening capacity across the NSS.

Myanmar: Myanmar's environmental concerns related to land accounting include loss and degradation of forest areas, land degradation and loss of habitat. In response, an interdepartmental working group has initiated the piloting of forest accounts. The role of the Central Statistical Organization, which has no in-house GIS capacity, is to contribute to coordination and management of standards and quality. This includes participating in the inventorying of forest-related data. Spatial and tabular data will be assessed for inclusion in a pilot forest account. Myanmar also has a OneMap project, which is in the process of integrating existing spatial data, which could contribute to a more general land account in the future. Challenges to be overcome include agreement on land cover and land use classes, resolving differences in data from different sources, and attributing values to land. Valuation is a challenge since national forest land is not exchanged on the market. Technical capacity to apply ecosystem valuation methods is also required.

Nepal: The Central Bureau of Statistics (CBS) has coordinated the production of pilot land accounts in collaboration with an inter-departmental stakeholder group and the International Centre for Integrated Mountain Development (ICIMOD). Initial challenges to be overcome included lack of technical capacity in CBS, differing national land areas and classifications, as well as the availability of official maps of land cover. Through the partnership, Nepal could identify appropriate, high quality data sources (ICIMOD), adjust the results to a consistent national land area, and analyse the changes over time. Further work on the accounts is expected to contribution to the national efforts to harmonize geospatial data (http://ngiip.gov.np) and the development of pilot forest accounts showing the change in forest area, timber stock, and supply and use of forest products, including ecosystem services.

The Netherlands: Statistics Netherlands (https://www.cbs.nl/en-gb/background/2017/12/ecosystem-unit-map) has initiated a project to develop a spatial, national ecosystem account. The high-resolution maps will support detailed reporting on physical and monetary values of ecosystem services such as crop, fodder, timber and other biomass production; water supply; carbon sequestration; erosion control; air filtration; water infiltration; pollination; pest control and nature recreation (hiking). The benefits of such an approach are seen as national sustainability monitoring as well as focussing investments of government and business on local areas with the greatest benefit.

The Philippines: The Philippines had produced Land Accounts in 1995 and more detailed forest accounts at the sub-national level in 1998. The current focus of the Philippine Economic-Environment Natural Resource Accounting program is to update these and other accounts (water and energy). Applying a bridge table between the national classification and the SEEA, preliminary estimates of forest cover and changes from 2003 to 2013 were produced. Challenges encountered in producing these accounts included data availability (deforestation rate, growth of natural forest), inconsistencies in geospatial information, coordination with data providers and validating results. Environmental concerns that are expected to be addressed by their forest accounts include deforestation, degradation due to population migration into forest areas, biodiversity loss and

improving monitoring of programs on forest management and rehabilitation. Further refinement of the accounts is expected to contribute to the Philippine Geoportal (http://www.geoportal.gov.ph/).

The Russian Federation: One motivation for the Russian Federation's work on natural resource statistics is to strengthen the valuation of the natural resource base and to support calculations of resource productivity. ROSSTAT is supporting this objective by developing approaches to land valuation by (a) market values of land exchanged and (b) assessing the value of future benefits.

The Russian Federation uses spatial data from two main sources within the government. A national spatial cadastral database is used as the primary source for land valuation, while the Ministry of Natural Resources and Environment provides additional spatial data on protected areas and forest. Working and collaborating with stakeholders on land evaluation will lead to discovery of other spatial datasets that can be used in a land accounting exercise.

Challenges currently being addressed include: valuing natural heritage lands, linking to the cadastral framework, valuing ecosystem services, and accounting for land, ecosystem and soil degradation.

Sri Lanka: Environmental concerns in Sri Lanka include, deforestation, mangrove degradation, coral reef destruction, soil degradation and vulnerability to climate change. The Department of Census and Statistics (DCS) compiles several types of environment statistics including land, forest, soil and ecosystems. These contribute to their SNA and SEEA sequences of accounts, depletion adjusted net savings and green GDP calculations, and environmental asset accounts. In collaboration with the Ministry of Mahaweli Development & Environment, the DCS has been able to provide indicators of forest degradation and enhancement. Challenges remain in terms of integrating and disseminating existing data. The proposed solution is to develop a common, national platform for spatial data integration and dissemination.

Thailand: Among Thailand's concerns that can be addressed with land accounts is the illegal invasion of state lands. This is often accomplished by the creation of fake land certificates. Difficulties in enforcing land laws and land ownership complicate city planning under times of rapid urban expansion. The objective of the new Land and Land Use Management Plan (2017-2021) is to maintain a balance between conservation and development of land, to manage land and soil more efficiently and to provide access equitably to the poor. As part of the Thailand Statistical Master Plan, the NSO is developing statistics related to soil, land and forest resources. This will integrate data from administrative sources on land allocation for agriculture, land use and rehabilitation. These will be combined with data from the agricultural census and satellite images on forest area under the NSDI and OneMap (2018) and published in the NGIS portal (http://www.ngis.go.th/home/). Remaining challenges include converting different standards and definitions in various land-related laws, access to and standardization of departmental data holdings, and lack of staff and budget to compile land accounts.

Timor-Leste: Environmental concerns include land degradation, deforestation, loss of biodiversity and coastal resilience to climate change. The current legal framework includes allowances for local customary (*Tara Bandu*) management of land management. The most recent comprehensive data available on land cover and land use were from the Sustainable Land Management project conducted in 2009. Recent work has applied GPS-encoded Census 2015 data to develop maps of population density.

Since Timor-Leste does not have legal provisions for an NSDI, spatial data are generally maintained in isolated databases. Challenges that need to be overcome include lack of technical capacity, centralized resources and common standards across policies, departments, and municipalities. These are to be addressed in a 5-year Strategic Action Plan to improve capacity for the planning, establishment and management of protected areas. The NSO plans to participate in the coordination of the plan.

Vanuatu: Vanuatu's environmental concerns to be addressed by land accounts include: depletion and degradation of forests, fish stocks, ecosystems and biodiversity. The role of the NSO is to implement the NSDS in support of the National Sustainable Development Plan in areas of food and agriculture; forest; energy; waste; water; land; and ecosystems. The compilation of pilot land accounts is in progress using spatial data from the Lands Department (Title Information System, and planned land value) and Forestry Department (land cover from VANRIS database by REDD+ in 2007). Validation of existing data is in progress and a search is ongoing for current land cover data. It has been a challenge compiling comparable land cover data for two reference points. Land valuation data are confidential, but access by the NSO is being negotiated. Historical data are not well structured or digitized. Capacity among the NSS to work with spatial data requires strengthening.

Viet Nam: Viet Nam's Payment for Forest Environmental Services (PFES) has developed statistics on forest status (timber supply, watershed and coastal protection and biodiversity conservation). Statistics compiled show the increase in forest area from 28% in 1990 to 40% in 2013. The national target is 43% by 2020. Under the PFES, users of forest services (hydro power plants, water supply companies, eco-tourism businesses, industrial users of groundwater, and facilities using services for carbon sequestration and aquaculture) pay the providers of the services (land owners) based on production (kWh power, m^3 water or percent of profits). Funds are distributed based on the quality of the forests owned. This collection of funds has resulted in the redistribution of $75M in 2016 to 4,422 communities and the creation of 376 thousand jobs. Challenges remaining to be addressed include completing detailed guidance documentation, allocating services to forest areas in inter-provincial catchment areas and creating sanction mechanisms for PFES violations. Awareness and capacity at the local level will be required to accelerate the program. For PFES users, the awareness will need to be strengthened and the formula for redistribution (K-coefficient) is too complicated for users to apply themselves. The success of the program is largely due to high-level political commitment to improve the value of forest services as well as a strategy for implementation and collaboration among institutions. Implementing national land and ecosystem accounts could support the establishment of an ongoing monitoring and evaluation system.

3.3 Related international initiatives

UNDP Reduction of Emissions from Deforestation and Degradation (REDD+): REDD+ is a program to incentivize the reduction of forest cover loss. Implementing SEEA land, forest and ecosystem accounts could contribute to setting realistic targets for national REDD+ strategies and action plans. For example, accounts could reveal the main drivers of deforestation (urbanization, agricultural expansion, mining and infrastructure). The economic benefits of these drivers and their environmental costs could help focus strategies on better managing low-benefit-high-cost activities. The accounts could also help improve the scope and coherence of valuation methods and incorporation of natural resource values in the measurement of national wealth (National Balance Sheet). A study applying the SEEA physical supply/use of forest products in Ethiopia revealed that the contribution of forest products to GDP was greatly undercounted since more than half the value of forest products was produced outside the forest sector (i.e., non-timber forest products). There are also opportunities for REDD+ to contribute to land, forest and ecosystem accounts by providing data from its national forest monitoring system and forest reference level for expected future changes. In India's tax devolution, 7.5% of the allocation of central government taxes to the states is based on forest cover. This is seen to provide an incentive to maintain forests rather than exploiting them for timber.

ESCAP Disaster Risk Statistical Framework (DRSF): The DRSF (http://communities.unescap.org/asia-pacific-expert-group-disaster-related-statistics) integrates spatial data on vulnerability, exposure to natural disasters, their occurrence and impacts, and the country's capacity to withstand impacts. In a 5-country pilot study, data from the Global Urban Footprint (GUF) were used to develop detailed population density maps. These were then combined with hazard maps to derive population exposure. A draft step-by-step manual on this method is available online

(https://drive.google.com/file/d/0B_evvbwdWP-iMHMwS0VhbEJfcDg/view?ts=59b117c0). Examples from a recent expert group meeting include examples of implementing the framework for determining population potentially impacted by oncoming cyclones, integrating and validating spatial data from various sources, and drought monitoring.

ESCAP Information and Communications Technology and Disaster Risk Reduction Division (IDD): ESCAP's Space Applications Section emphasizes the role of using geospatial data for decision making, contributing to productivity and efficiency in socio-economic activity and promoting a 3-dimensional development paradigm. The section has conducted analyses to identify optimal areas for distributing salt-tolerant rice seeds, to develop drought monitoring and hazard maps for China, to produce hazard damage assessments, and to contribute to risk resilient land-use planning. These have applied a Statistical Geospatial Framework, which integrates georeferenced statistics with geospatial data. Their Regional Space Applications Programme for Sustainable Development (RESAP) has contributed to early warning systems and geospatial indicators for disaster-related SDG monitoring. Statistical geospatial indicators are proposed as providing a positive message focussing on actions to reduce risks before disasters.

UN Environment/UNDP Poverty Environment Initiative (PEI): Environmental degradation and disasters disproportionately impact the poor in most countries. The PEI is extending land, forest and ecosystem accounting to better incorporate the measurement of social benefits of environmental management to beneficiaries. A pilot project in collaboration with the Government of Bangladesh (coordinated by the Bangladesh Bureau of Statistics) is combining data on national land cover with household surveys to determine localities where interventions to improve environmental quality or reduce disaster risks would have the greatest benefit for poverty alleviation.

Geoinformatics Center, Asian Institute of Technology (AIT): The Geoinformatics Centre is engaged in several projects to use spatial data to improve disaster risk and resilience assessment. One is the Emergency Response Data Viewer for the 2017 Sri Lanka floods that integrates data from several recent satellite images, crowdsourced photos and population data to show flood extent, and impact.

The data viewer uses an object-oriented classification approach for large scale mapping of built-up land. It also applies a crowdsourcing approach (http://www.geoinfo.ait.ac.th/ukd/) to identify, in more detail, buildings (e.g., homes, schools, office buildings, commercial centres) that are most vulnerable to hazards such as floods. AIT is also supporting a geoportal for spatial data sharing in Tonga (http://202.134.25.30/), Fiji (http://www.fijigeoportal.gov.fj/) and Micronesia (http://www.geoportal.oeem.gov.fm/), and the application of drones to asses vegetation health and land cover.

3.4 Challenges and lessons learned

Many of the challenges in land accounting were similar to those for environment statistics in general. Participants noted constraints such as lack of access to data, poor coordination among stakeholders and inconsistency in data collected by various stakeholders. In countries where there was high-level political support and strong coordination, these constraints were more likely to be overcome. In many countries, the NSO undertakes the role as the "standards keeper" and advises stakeholders on international standards and quality.

The lack of technical capacity, especially within NSOs, to work with spatial data across the national statistical system was also highlighted. In many countries, the NSO has substantial capacity to work with spatial data. In these cases, they can also play an important role in maintaining spatial standards (projections, scales, data sources, data quality, accuracy and metadata).

In the case of spatial data, there is an overwhelming source of satellite imagery publicly available for land cover. They range in resolution from the 1 kilometre FAO's Global Land Cover down to the 30-metre GlobeLand30 land cover produced by China.

Several countries have the ability and resources to take raw satellite data such as Landsat 30 metre and apply their own algorithms and classifications to derive land cover. Others work with existing national land cover sources (maps), while some others work with international agencies to develop appropriate spatial data.

Countries with the capacity to exploit these land cover spatial datasets, may not be able to make a choice among these sources. They must then take into consideration not only the resolution of these datasets, but also availability of them over time. This time series component is an important aspect of choosing which land cover dataset to use; as one of the goals in a land accounts is the ability to look at land cover change over time and construct a land cover change matrix.

Much global satellite imagery is at a lower resolution and only available for one period and therefore may be inadequate to represent and land cover at the national level.

There are, however, two global datasets that are recommended as a base for land accounts. These are the European Space Agency 300 metre (ESA) land cover time series (1992-2015) and China's 30 metre Global Land (2000 – 2010) land cover. Both these datasets are at a finer resolution, available for two or more periods, have been developed using consistent methodology and metadata and in the case of the ESA 300m follows the United Nations Land Cover Classification System (LCCS).

Several countries noted the need for validation of global data with national sources. Although global land cover datasets come with some degree of accuracy assessment or confidence level, areas can be misclassified. Rather than using these data without validation, supplemental spatial data from other data providers can be used to validate or replace the satellite derived land cover, if required. These data can be national spatial data holdings or localized vector spatial layers (cadastral, forest area, water features, urban areas, road network, wetlands, etc.). In most cases national or localized spatial data maybe more accurate than public satellite data in identifying what is physically on the land.

Another step in the validation process is to bring into a GIS, an image service such as Google Maps satellite layer or BING maps aerial and use these image service as a backdrop. These image services in some instances offer the ability to bring up older historical satellite imagery which is valuable when looking at land cover change.

Approaches developed by countries for land accounts tend to be either bottom-up (compiling national statistics on different land covers and uses) or top-down (beginning with a national map, such as from satellite imagery). Both approaches, in conjunction, can be beneficial since top-down provides an agreed view of the national territory by establishing national boundaries, areas and classifications. Bottom-up approaches could then be applied to validate this national overview with statistics on, for example, agricultural area and forest area.

Monetary valuation of land, forests and ecosystem services was flagged as a common challenge. Although the SEEA-CF and SEEA-EEA provide some guidance on valuation, it is insufficient to provide precise methods under all conditions. In cases where countries encounter challenges in valuation not documented in the SEEA, they are encouraged to engage SEEA experts to develop and test new methods.

NSOs also have an opportunity to enhance this role by strategically communicating analytical findings to decision makers, the media and the public. Interdepartmental working groups have raised awareness of national planning issues by focussing releases on (a) the priority being addressed, (b) how the statistics inform these priorities and (c) what cannot be said given the current data.

Two countries showed substantial progress using existing data to support monetary incentives for land and forest management. In the case of Viet Nam, the area and quality of forest is used to reallocate taxes on ecosystem services users to providers. In India as well, forest extent is a

component of the redistribution of federal tax payments to the provinces. Ongoing land and ecosystem accounts could improve the long-term rigour of such incentives.

3.5 Conclusions

National planning for sustainable development would be enhanced if national statistical offices strengthened their capacity to participate in the creation, development, standardization and application of land-related data and statistics. In many countries, this is hampered by not only the lack of technical and human resources, but also the lack of a strong role of NSOs in coordinating national spatial data.

Participants suggested that expert workshops of this nature were extremely useful to learn from other countries' experiences, as well as establish bilateral working relationships between countries and other regional and international agencies. Participants indicated that the workshop enhanced their understanding and skills on land accounting and its extensions; and they felt confident in applying the knowledge gained from this workshop. They also supported putting related materials and case studies online in an online resource platform, so that they could then build capacities in their own countries.

4. References

United Nations Statistics Division. 2013. Framework for the Development of Environment Statistics (FDES) 2013. United Nations Statistics Division, New York. Retrieved from https://unstats.un.org/unsd/environment/FDES/FDES-2015-supporting-tools/FDES.pdf.

United Nations, European Commission, Food and Agriculture Organization, International Monetary Fund, OECD, World Bank. 2014a. System of Environmental-Economic Accounting 2012 - Central Framework. United Nations Statistics Division, New York, NY. Retrieved from https://unstats.un.org/unsd/envaccounting/seeaRev/SEEA_CF_Final_en.pdf.

United Nations, European Commission, Food and Agriculture Organization, OECD, & World Bank. 2014b. *System of Environmental-Economic Accounting 2012 - Experimental Ecosystem Accounting*. New York, NY: United Nations Statistics Division. Retrieved from http://unstats.un.org/unsd/envaccounting/seeaRev/eea_final_en.pdf.