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Towards the Assessment of Trees Outside Forests

A Thematic Report prepared in the framework of
The Global Forest Resources Assessment

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Cover photos:

Left, top to bottom: Trees in an agroforestry parkland (S. Bouju), trees on a farm (H. de Foresta, IRD), linear tree formation (H. de Foresta, IRD)

Centre: trees in the city (H. de Foresta, IRD)

Right, top to bottom: trees in pasture (H. de Foresta, IRD), biodiversity and trees outside forests (H. de Foresta, IRD), forest products and trees outside forests (H. de Foresta, IRD).

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TOWARDS THE ASSESSMENT OF TREES OUTSIDE FORESTS

A Thematic Report prepared in the framework of The Global Forest Resources Assessment 2010

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Comments and feedback are welcome

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Dedication

This book is dedicated to Michelle Gauthier, a forestry officer at the FAO Forestry Department, who passed away suddenly in February 2013. Michelle championed urban forestry and agroforestry as important means for improving the livelihoods of millions of peoples, and she was the driving force in the publication of this book.
She will be sorely missed.

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FOREWORD

Trees Outside Forests (TOF) can play important roles in national economies, ecosystems, and international efforts for sustainability – and in many places they already do. At the local level, people have long relied on TOF in various land-use settings for food security, income, and biological diversity. Forest professionals in many countries support local use of trees for these purposes, outside forests as well as in forest settings. More recently, international programmes build on trees' roles in providing essential environmental services to encourage sustainable land management, carbon sequestration to mitigate climate change, and local economic development.

In the 1990s, FAO recognized that TOF are typically splintered among the components of agroforestry, urban and rural forestry, and other disciplines. TOF tend to be left out of forest statistics, natural resource assessments, policy, and legislation. An expert meeting held in Finland in 1996 recommended that FAO address the need for hard data on TOF. As a result, a thematic study on TOF was included in the Global Forest Resource Assessment (FRA) 2000. Along with several publications on the issue, the FAO Forestry Department included TOF in the National Forest Monitoring and Assessment (NFMA) Programme and other country-level reporting efforts.

A major challenge for a better valuation of trees and their services globally remains in better understanding the status and dynamics of all tree resources, including TOF ("Trees Outside Forests: Towards Rural and Urban Integrated Resources Management," 2001)." What little data are available often are entered using methods unlike the ones typically used in forest resource assessments. This may be one reason why TOF are so often invisible in reports about how people use trees and forests.

The objective of this study is to advance toward improved assessments. Navigating the overlapping patterns of trees in landscapes, this report aims to create a more coherent assessment framework compatible with the FRA approach that FAO has refined through FRA 2005 and FRA 2010.

With a view ahead to the 2015 global assessment, the methods in this report and case studies illustrating their use will help provide a more complete picture for international, national, and local efforts to manage trees and land for people's benefits. Different agencies in national and regional governments may have different reasons for why they gather data on TOF and why they report it to FAO. The FRA 2010 provides a starting point, along with other international programmes developed by FAO and its partners (see Chapter 3). This report takes that further, acknowledging where ambiguities remain and clarifying categories and usage where possible.

The report was developed based on recommendations from the Kotka V Expert Consultation on the Global Forest Resource Assessment (June 2006) that a special study on TOF should be included in FRA 2010. An inception workshop for the study was held in Rome (June 2010). During the workshop, 42 experts from 31 institutions in 17 countries defined the objectives, scope and process for developing the study. Considering that quality large area TOF assessments are a sine qua non condition for TOF to be integrated into development policies, the workshop recommended that the main outcome of the thematic study be a report including:

- ✓ A review and comparative analysis of large scale (national and regional) assessments of TOF,
- ✓ A set of methodological and technical options for national-level assessments of TOF, including an operational typology, enabling reporting to international processes such as FRA and IPCC.

A small team was then formed to carry out the study and prepare the report. A first draft was peer-reviewed by the workshop experts

and by FAO officers from various services and departments.

The report is intended to support national agencies responsible for forestry, agriculture, environment, and rural and urban development, by providing adapted tools and methods to assess resources of TOF, as well as their products, uses and economic and environmental functions, at a national level. Through such assessments, local and national decision-makers will be better able to take into account TOF resources and the services they provide. This support to decision-makers and land-use planners is especially important for developing countries as the contribution of TOF to people's livelihoods and national economies is expected to dramatically increase in the current context of climate change, biodiversity crisis, financial crises, and food insecurity.

This report is intended to support national agencies responsible for forestry, agriculture, environment and rural and urban development by providing tools and methods to assess TOF resources, as well as their products, uses and economic and environmental functions, at the national level. Through such assessments, local and national decision-makers will be better able to take into account TOF resources and the services they provide. This is especially important in many developing countries, where the contribution of TOF to people's livelihoods and national economies is likely to increase dramatically if predictions of future climate change, biodiversity loss and food insecurity are accurate.

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This report on trees outside forests is the result of a multi-institutional collaboration involving specialists from various disciplines worldwide. It was initiated by the FAO-Finland Sustainable Forest Management in a Changing Climate Programme (GCP/GLO/194/MUL).

This document was prepared under the overall leadership of Michelle Gauthier, Forestry Officer of the FAO Assessment, Management and Conservation Division of the Forestry Department, and the guidance of the Coordinator of the Forest Resources Assessment Programme, Kenneth MacDicken. The scientific and technical coordination of the publication was carried out by Hubert de Foresta of the Research Development Institute (IRD) from France. Désirée Boulanger and Hélène Feuilly were indispensable during the first year in assisting researching, collecting and analysing the information contained in parts II and III.

The richness of this report is due to the multistakeholder process that was in place from the beginning of the process to the end of it. The participants of the two inception workshops held at FAO headquarters, Rome, for the development of agroforestry guidelines (7–8 March 2010) and the assessment of trees outside forests (9–10 March 2010) set the participatory process, the objectives, the provisional content of the report and the task force. The authors thank specially those participants: Rik De Vreese (Belgium), Yoshio Shimabukuro (Brazil), Jinlong Liu (China), Chaozong Xia (China), Guillermo Navarro C. (Ecuador), Eduardo Somarriba (Costa Rica), Miguel Adrián Cordero Velásquez (Guatemala), Christian Dupraz (France), Hubert de Foresta (France), Martial Bernoux (France), Denis Gautier (France), Christoph Kleinn (Germany), Michael Koehl (Germany), Stefanie Poepken (Germany), Sebastian Schnell (Germany), Manoj Dabas (India), Prakash Lakhchaura (India), Maria Vincenza Chiriacò (Italy), Piermaria Corona (Italy), Toby Hodgkin (Italy), Angelo Mariano (Italy), Marco Marchetti (Italy), Shantanu Mathur (Italy), Flora De Natale (Italy), Giuseppe Pignatti (Italy), Jésus Quintana (Italy), Fabio Salbitano (Italy), Giovanni Sanesi (Italy), August Temu (Kenya), Jean-Marc Boffa (Malta), Robert J. Zomer (Nepal), Michael Idowu (Nigeria), Labode Popoola (Nigeria), Ignacio Lombardi Indacochea (Peru), El Hadi M. Sène (Senegal), Felician Bakamaza Kilahama (United Republic of Tanzania); John Spears (United States of America), Giorgos Mountrakis (United States of America).

For developing the Part II of the report and for other case-studies, we counted on the valuable contribution of more than 35 experts from national and institutional with expertise at local, national and global level. We would specially like to express our very great appreciation to those participants coming from 28 following countries: Canada, China, Denmark, France, India, Ireland, Morocco, New Zealand, Nepal, Nicaragua, Norway, Philippines, Senegal, Slovenia, Sweden, United Kingdom, Uruguay and USA. The list of these experts is contained in the List of Contributors.

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"A picture is worth a thousand words": the challenge was achieved thanks to the dedication of Stéphane Bouju and Hubert de Foresta in selecting the superb illustrations used in this report from their collections of thousands of photographs.

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PRESENTATION OF THE REPORT

This study is organized in three main parts, reflecting the recommendations of experts and country representatives.

Part 1 consists of the report's main text, outlining the purpose of a Trees Outside Forests (TOF) assessment and how to accomplish it. The first chapter presents the background and rationale for the thematic study, and explains the focus on the national and sub-national levels of TOF assessment. Chapter 2 identifies situations in which TOF may be encountered, and analyses the place of land with TOF in FAO's framework of land classification. Chapter 3 reviews large-area assessments regarding TOF with one global assessment, one regional assessment, 33 national assessments, and 3 assessments at the sub-national scale. Based on the previous chapters, Chapter 4 provides options for countries in developing large-area TOF assessments. Selecting among those options depend on quantity, quality and relevance of existing data; the assessment objectives; and available resources. Chapter 5 distills the main conclusions and recommendations.

Part 2 illustrates these methods with case studies and descriptions of international programmes. It synthesizes information on the 38 assessments previously mentioned and on international support programmes.

Part 3, a guide for TOF identification, is a collection of satellite images that further illustrate the various components of Other Land with TOF, the diversity of land uses found, and how to identify them. Seventy high-resolution satellite images, covering all subsets of TOF in various biophysical and human settings, offer examples for classification using the FAO-FRA framework.

ABBREVIATIONS AND ACRONYMS

ASL	above sea level
CATIE	Tropical Agricultural Center for Research and Education
CIFOR	Center for International Forestry Research
CIRAD	Center for International Agricultural Research for Development
COP	Conference of the Parties to UNFCCC
FRA	Global Forest Resources Assessment
GDP	gross domestic product
GEF	Global Environment Facility
GLCN	Global Land Cover Network
ICIMOD	International Centre for Integrated Mountain Development
ICRAF	World Agroforestry Centre, formerly International Centre for Agroforestry

Research

IFAD	International Fund for Agricultural Development
IUFRO	International Union of Forest Research Organizations
LADA	Land Degradation Assessment in Drylands
LCCS	Land Cover Classification System
LUCS	Land-Use/Cover Section
LU/LC	Land-use/Land-cover
MRV	measurement, reporting and verification
NFI	national forest inventories
NFMA	National Forest Monitoring and Assessment
NGO	non-governmental organization
NWFP	non-wood forest product
OLWTC	Other Land With Tree Cover
PES	payment for environmental services
REDD	Reducing Emissions from Deforestation and Forest Degradation
SBSTA	Subsidiary Body for Scientific and Technological Advice
TOF	Trees Outside Forests
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UNSD	United Nations Statistics Division
WISDOM	The Woodfuel Integrated Supply/Demand Overview Mapping

GLOSSARY

Agricultural system: An agricultural system is an assemblage of components which are united by some form of interaction and interdependence and which operate within a prescribed boundary to achieve a specified agricultural objective on behalf of the beneficiaries of the system.
(FAO stat, FAO Farm Systems Management Series – 13)

Canopy cover: The percentage of the ground covered by a vertical projection of the outermost perimeter of the natural spread of the foliage of plants. Cannot exceed 100 percent. (Also called crown closure) Same as crown cover.
(IPCC. 2003. Good Practice Guidance for LULUCF - Glossary)

Forest: Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.
Explanatory notes

1. Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 meters in situ.
2. Includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of 10 percent and tree height of 5 meters. It also includes areas that are temporarily unstocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within 5 years. Local conditions may, in exceptional cases, justify that a longer time frame is used.
3. Includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific environmental, scientific, historical, cultural or spiritual interest.
4. Includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectares and width of more than 20 meters.
5. Includes abandoned shifting cultivation land with a regeneration of trees that have, or is expected to reach, a canopy cover of 10 percent and tree height of 5 meters.
6. Includes areas with mangroves in tidal zones, regardless whether this area is classified as land area or not.
7. Includes rubber-wood, cork oak and Christmas tree plantations.
8. Includes areas with bamboo and palms provided that land use, height and canopy cover criteria are met.
9. Excludes tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations and agroforestry systems when crops are grown under tree cover. Note: Some agroforestry systems such as the "Taungya" system where crops are grown only during the first years of the forest rotation should be classified as forest.

(FAO. Guidelines for Country Reporting to FRA 2010)

Inland water bodies: Inland water bodies generally include major rivers, lakes and water reservoirs. (FAO. Guidelines for Country Reporting to FRA 2010)

Other land with no tof: Land classified as Other Land, with no tree and/or no shrub cover or with trees or shrubs but with an area is < 0.05 ha, canopy cover < 5% if trees are present, or < 10% if combined trees, bushes and shrubs, or for linear structures a width < 3 m or length < 25 m.
Explanatory notes:

1. Includes inland water bodies, barren land, stone outcrops, snow caps and glaciers, deserts, peat bogs, meadows without trees, annual crops without trees, etc...
2. Includes large areas with very scattered trees or shrubs

Other land with tof: Land classified as Other Land –i.e. not classified as Forest nor Other Wooded Land-, spanning more than 0.05 hectares with trees higher than 5 meters and a canopy cover above 5 percent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 percent. It includes land that is predominantly under agricultural or urban use. It also includes some land that is not predominantly under agricultural or urban use".
Explanatory notes:

1. Includes all areas with trees or/and shrubs on land that is predominantly under agricultural use.
2. Includes all areas with trees or/and shrubs on land that is predominantly under urban use.
3. On land that is not predominantly under agricultural or urban use, includes: areas spanning less than 0.5 ha; windbreaks, shelterbelts and corridors of trees and shrubs, with an area spanning less than 0.5 ha or a width of less than 20 m but more than 3 m;

Other land with tree cover (sub-category of Other land): Land classified as Other land, spanning more than 0.5 hectares with a canopy cover of more than 10 percent of trees able to reach a height of 5 meters at maturity.
Explanatory notes

1. The difference between Forest and Other land with tree cover is the land use criteria.
2. Includes groups of trees and scattered trees in agricultural landscapes, parks, gardens and around buildings, provided that area, height and canopy cover criteria are met.
3. Includes tree stands in agricultural production systems, for example in fruit tree plantations and agroforestry systems when crops are grown under tree cover. Also includes tree plantations established mainly for other purposes than wood, such as oil palm plantations.
4. Excludes scattered trees with a canopy cover less than 10 percent, small groups of trees covering less than 0.5 hectares and tree lines less than 20 meters wide.

(FAO. Guidelines for Country Reporting to FRA 2010)

Other land: All land that is not classified as Forest or Other wooded land.
Explanatory notes

1. Includes agricultural land, meadows and pastures, built-up areas, barren land, land under permanent ice, etc.
2. Includes all areas classified under the sub-category "Other land with tree cover".

(FAO. Guidelines for Country Reporting to FRA 2010)

Other wooded land: Land not classified as Forest, spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.

Explanatory notes

1. The definition above has two options: The canopy cover of trees is between 5 and 10 percent; trees should be higher than 5 meters or able to reach 5 meters in situ. or The canopy cover of trees is less than 5 percent but the combined cover of shrubs, bushes and trees is more than 10 percent. Includes areas of shrubs and bushes where no trees are present.
2. Includes areas with trees that will not reach a height of 5 meters in situ and with a canopy cover of 10 percent or more, e.g. some alpine tree vegetation types, arid zone mangroves, etc.
3. Includes areas with bamboo and palms provided that land use, height and canopy cover criteria are met.

(FAO. Guidelines for Country Reporting to FRA 2010)

Shifting cultivation: A land utilization method; a particular piece of land is cultivated for some years and then abandoned for a period required to restore its fertility by natural vegetative growth; it is then cultivated again. The distinguishing feature of shifting cultivation is that neither organic fertilizers nor manure are used to retain soil fertility.

(FAO. 1996. Conducting agricultural censuses and surveys. FAO Statistical Development Series, No. 6. Rome.)

Shrub: Woody perennial plant, generally more than 0.5 meters and less than 5 meters in height at maturity and without a definite crown. The height limits for trees and shrubs should be interpreted with flexibility, particularly the minimum tree and maximum shrub height, which may vary between 5 meters and 7 meters.

(FAO. Guidelines for Country Reporting to FRA 2010)

TOF: Trees, bamboos, palms, shrubs and bushes found in Other Lands

TOF-AGRI: TOF-AGRI includes all lands predominantly under an agricultural use with trees and/or shrubs whatever their spatial pattern (in line, in stands, scattered), provided that the area is ≥ 0.05 ha, the canopy cover is ≥ 5% if trees are present, or ≥ 10% if combined trees, bushes and shrubs, the width ≥ 3 m and the length ≥ 25 m.

TOF-URB: TOF-URB includes all lands predominantly under an urban use with trees and/or shrubs whatever their spatial pattern (in line, in stands, scattered), provided that the area is ≥ 0.05 ha, the canopy cover is ≥ 5% if trees are present, or ≥ 10% if combined trees, bushes and shrubs, the width ≥ 3 m and the length ≥ 25 m.

TOF NON A/U: TOF-NON A/U includes all lands not predominantly under agricultural or urban use, with

Subset 1: small tree stands (0.05 ≤ area <0.5 ha), with canopy cover ≥ 5% if trees are present, or ≥ 10% if combined trees, bushes and shrubs.

Subset 2: narrow linear tree formations, (3 m ≤ width < 20 m), with canopy cover ≥ 5% if trees are present, or ≥ 10% if combined trees, bushes and shrubs.

TREE: A woody perennial with a single main stem, or in the case of coppice with several stems, having a more or less definite crown.

Explanatory note

1. Includes bamboos, palms, and other woody plants meeting the above criteria.

(FAO. Guidelines for Country Reporting to FRA 2010)

EXECUTIVE SUMMARY

Background

The concept of "Trees outside Forests" -TOF- emerged in 1995 to designate trees growing outside the forest and not belonging to Forest or Other Wooded Land. The term represents an effort to concentrate attention that had been spread out on components of this rather diffuse resource: agroforestry, silvopastoralism, urban and rural forestry, and other related disciplines. In policy and public discourse, these important resources were overlooked.

The importance of Trees outside Forests for sustainable and integrated land management prompted the Expert Meeting on Global Forest Resources Assessments, held in 1996 in Kotka, Finland (Kotka III), to recommend that FAO and the FRA programme take steps to improve the data on this sector.

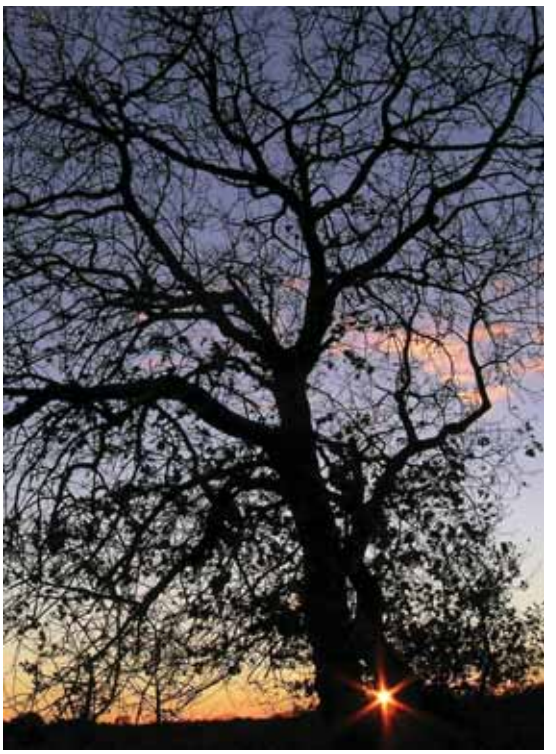
In response, the TOF issue was included into the Global FRA 2000 process. An expert consultation on "enhancing the contribution of TOF to sustainable livelihoods", held in FAO-Rome (November 2001), produced various reports and publications, and the synthesis "Trees outside Forests: Towards better Awareness" (FAO conservation Guide 35, 2002). The FAO Forestry Department held regional training workshops such as the workshop on "Assessment of TOF" held in April 2002 in Dehradun, India, and the project on "the role of planted forests and trees outside forests in landscape restoration in low forest cover countries" (FAO 2004).

In parallel with these efforts to raise awareness about TOF, the FAO Forestry Department took two important initiatives to support integration of TOF into national assessments:

- ✓ Including TOF into the National Forest Monitoring and Assessment Programme (NFMA). As of 2010, the programme has provided direct support to more than 15 countries that have implemented national inventories in and outside forests.

- ✓ Including information on the extent of a TOF subset –Other Land with Tree Cover (OlwTC)- in the country reporting tables to global FRA. The number of countries and territories that filled the OLwTC line increased from 61 in FRA 2005 to 77 in FRA 2010.

Despite measurable progress, hard data on TOF across large areas (sub-national and national levels) remains scarce. Countries expressed their need for support with methods and techniques for a better assessment of TOF resources. They requested that FAO prepare a thematic report on TOF as part of FRA 2010, including technical guidelines for better integrating TOF into the FRA 2015 reporting process.



Objectives and content

FAO organized an "Inception Workshop of the Thematic Study on TOF", held in Rome in June 2010, attended by 42 experts from 17 countries, coming from governmental organizations, international (CATIE, ICIMOD, ICRAF, IFAD, IUFRO, AU Commission, World Bank) and national institutions (CIRAD, IRD), universities and NGOs.

Through a focus on TOF assessment, this thematic report aims to enable the provision of better information on TOF for informed decisions that optimize tree and forest resources for sustainable development and food security.

As recommended, this study focuses on two main products:

- ✓ **Product 1:** A review of past and current large-area TOF assessments, as a basis for formulating technical and methodological options for new TOF assessments.

- ✓ **Product 2:** A conceptual framework including i) typology and variables for TOF assessment, (ii) on which countries can superimpose their objectives and (iii) select technical and methodological options adapted to their needs and resources.

The Thematic Report follows the Inception Workshop recommendations as far as possible, and consists of three main parts (see Presentation of the Thematic Report):

- ✓ **Part 1 – Towards Assessing Trees Outside Forests: why, what and how:** the report itself presents a rationale for TOF assessment. Building on definitions, it identifies the situations where TOF can be encountered, and analyses the place of land with TOF in the FAO land classificatory framework. It proposes a formal definition of Land with TOF, as a sub-category of Other Land in that framework. It reviews past and current assessments that include or may include TOF. Finally, it puts forward options for countries that want to implement TOF assessments, with options depending on the existing data, and objectives and resources.

- ✓ **Part 2 – TOF assessment case studies:** a compendium of the 38 assessments and the 4 international support programmes analysed as case studies for the review (Part 1, chapter 3). The assessments cover a very large range of environmental and socio-economic conditions, carried out in almost all the major world regions. The assessments also cover the main methods in use and the three TOF sets: agriculture, urban and other land uses.

- ✓ **Part 3 – TOF from the air - a guide for identification:** provides an illustrated guide to TOF, with the aim of facilitating classificatory decisions. A collection of high resolution satellite images, covering all TOF subsets in a variety of biophysical and human settings are presented, analysed, and used as examples for the classification of any piece of land into the FAO-FRA classificatory framework (see Figure 1).

"TOF from the Air - a guide for identification: an exemple from Sumatra, Indonesia"

In the analysis of this satellite image (Sumatra, Indonesia - 3°30'03"N ; 98°49'14"E), the first step of the classification process is the delineation of land units based on a relatively homogeneous land-cover. In the present example, four categories of land units have been identified. Results of the use of the Decision Tree algorithm are detailed for each category.

A: Mosaic of large oil palm plots with a regular and very dense tree cover. All trees are TOF *(because the use is predominantly agricultural).*

The whole area is classified as **Other Land *with TOF*** *because the land is predominantly under agricultural use (thus classified as Other Land), tree height is more than 5m, the tree canopy cover is more than 5 percent, and the area is more than 0.05 hectares.* This area can be further classified as **Other Land with Tree Cover** (a sub-category of Other Land satisfying to the same biophysical thresholds as the Forest category), *because the area is more than 0.5 hectares, and the canopy cover is more than 10 percent.*

B: Mosaic of crop fields and houses, with no or scarce isolated trees. All trees are TOF *(because the use is predominantly agricultural).*

The B patches are classified as **Other Land *with No TOF*** *because the land is used for agriculture and housing structures (thus classified as Other Land), and the tree canopy cover is lower than 5 percent, which is the minimum threshold for the Other Land with TOF category.*

C: Settlement area with homegardens, houses, streets, with a dense but heterogeneous cover of trees. All trees are TOF *(because the use is predominantly agricultural and urban).*

The area as a whole is classified as **Other Land *with TOF*** *because the land is mainly used for housing structures and homegardens (thus classified as Other Land), tree height is more than 5m, the tree canopy cover is more than 5 percent, and the area is more than 0.05 hectares.* This area can be further classified as **Other Land with Tree Cover** *because the area is more than 0.5 hectares, and the canopy cover is more than 10 percent.*

D: Area with no or scarce isolated trees, probably a flooded area. All trees are TOF *(because, although the land is not under predominantly agricultural or urban use, the tree canopy cover is lower than 5 percent, which is the minimum threshold for the Other Wooded Land category).*

The area is classified as **Other Land *with No TOF*** *because it satisfies neither the land-use criteria nor the biophysical thresholds of the categories Forest and Other Wooded Land (thus classified as Other Land),* and *because the tree canopy cover is lower than 5 percent, which is the minimum threshold for the Other Land with TOF category.*

Major Findings

TOF are trees that do not fulfill the criteria of Forest, so the TOF realm depends on the definition used for Forest in any country or agency conducting an assessment. TOF can be found in all climates, land types, land uses and regions. They ensure a multitude of ecological, economic, social, and cultural functions, that in many cases are vital for human livelihood.

The TOF set as it is understood in this report, is in the tree realm the complement of the combined two FAO categories, Forest and Other Wooded Land. For clarity, Other Land may be subdivided in two mutually exclusive sub-categories: *with TOF* and *with No TOF*. Based on the presence of TOF at minimum threshold levels, operational definitions are given for the two sub-categories.

Other Land *with TOF* (OL*wTOF*) consists of three sets: lands predominantly under agricultural use; lands predominantly urban; and lands neither urban nor agricultural (small tree stands and narrow linear formations).

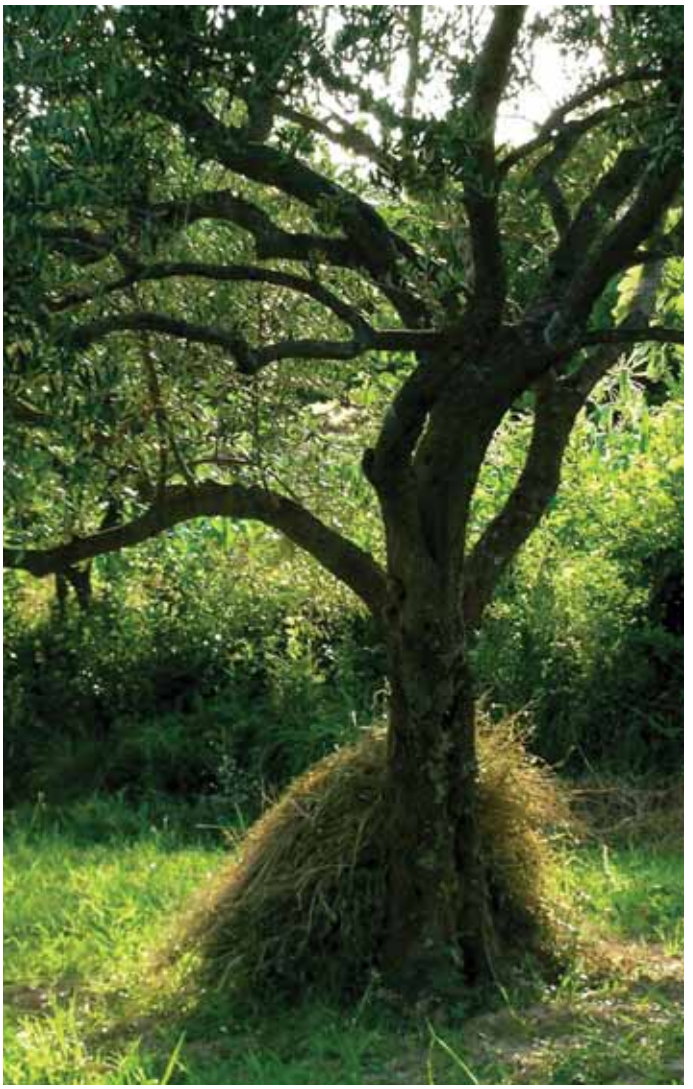
These three TOF sets involve a large range of stakeholders: farmers, pastoralists and institutions linked to agriculture and rural development; people living in settlements and cities and institutions linked to urban management and development; environmental organizations, rural and urban planning institutions, etc.

The review of the 38 large-area assessments showed that the TOF concept is just beginning to be considered in national assessments.

Recent progress has included:

- ✓ One global scale TOF assessment (Trees on Farm, 2009). The results are extremely important and provide an order of magnitude of the global extent of TOF on agricultural land: approximately 10 million km² (or 46% of the total "agriculture land") have more than 10% tree cover.
- ✓ Many countries have available national assessments that provide (or may provide after data re-analysis) information on some TOF sets.
- ✓ Countries that have implemented the NFMA approach have successfully integrated TOF and TOF issues into their national forest (and tree) assessments. These countries may provide convincing estimates of the various variables related to the TOF resources, although their precision could be greatly enhanced by an increase in sampling intensity.
- ✓ Countries have implemented assessments of their tree and forest resource that are so detailed that they may provide estimates of biophysical variables related to TOF. A few countries have undertaken specific TOF assessments. These countries show that assessing TOF at national scale is possible, and that there are no insurmountable technical or methodological obstacles as long as TOF categories are consistent and the assessments organized in a complementary way.

Assessing TOF does not require methods radically different from those used in assessing forests: Low- and high-resolution remote-sensing images are used in the same way. Sampling for inventory proceeds the same way as for forests. Field inventory protocols and survey questionnaires are similar to those used for forest. Sampling, field inventory protocols and survey questionnaires could require adaptation, just as they do for certain kinds of forest in a forest assessment (for instance savannah woodland, rubber plantations and Acacia mangium plantations).



There is no methodological or technical obstacle to large-area TOF assessments. Furthermore, this report sets up a rigorous and operational land classificatory framework that includes TOF.
It is essential to acknowledge the range of land uses that involve TOF for:

- ✓ Building an efficient and legitimate institutional framework. Assessments need an ad hoc multi-sector institutional framework that includes the forest sector and the sectors that are legitimate for the other TOF sets (environment, agriculture, rural development, transportation, city planning, etc.).

- ✓ Setting up a sound land classificatory framework adapted to local reality, so that the land-use/land-cover classes explicitly allow unequivocal assessment of TOF sets and subsets.

Credibility of results requires sound protocols and sampling schemes, pre-evaluated by statisticians, to ensure that they will (1) yield credible results, (2) achieve the desired allowable error estimates for the targeted state and change estimates, (3) permit statistically defensible assessment of uncertainty, and (4) permit assessment of quality assurance and control.

The national TOF assessments reviewed in Chapter 3 provide useful models, much as pioneer national forest assessments were. Still, adaptation to national targets and ecological, social and economic situations are required, keeping in mind that different methods provide different kind of results.

Recommendations

Four major recommendations result:

1. Carry out national TOF assessments. This report provides all the practical keys necessary. Due to the importance of the TOF issue for the three international conventions (CBD, UNFCCC and UNCCD), countries that need assistance and guidance can look for support by the international community. If political will is there, no reason can now prevent a country to assess its TOF.

2. Clarify FAO-FRA position regarding global TOF assessments. At FAO, the Agriculture and Consumer Protection department compiles national statistics on major non-timber tree crops (which are TOF), but the FRA programme is currently the only international programme that explicitly compiles national information on TOF. Three options for improving this might be:

   - The FRA programme sets up an ad-hoc multi-sector committee in charge of TOF national reporting,
   - FAO sets up a new ad-hoc TOF Resources Assessment programme including experts from the relevant departments.
   - A combination of the above options, with the initial multi-sector committee under the FRA programme becoming an independent programme once national and international TOF assessments reach a certain threshold.

3. Take action for FRA 2015. It is very important that efforts to integrate information on TOF in the regular assessments of global forest resources be continued in FRA 2015. The FRA programme should refine the definitions of a few terms so that in practice the frontier between Forest, Other Wooded Land, and Other Land with TOF can always be objectively defined. This is urgently needed because remaining ambiguities in terms may spell some doubts on the forest data reported in the last global forest assessments. Three technical improvements are thus recommended for FRA 2015:

   - Reduce subjectivity in national reporting to FAO-FRA: Improve the definitions, especially "agricultural use," "urban use" and "abandoned shifting cultivation."
   - Improve country reporting on the extent of Other Land With Tree Cover. Only a few countries can, at this stage, contribute relevant data to a global TOF assessment that would encompass more than the most basic variables. Rather than add new variables, it is more effective to ensure a higher response rate from countries on the extent of OLwTC. Early involvement of national agricultural and urban services is recommended.
   - Develop a global TOF assessment in the FAO FRA Remote Sensing Survey. The FRA Remote Sensing Survey has been instrumental in improving regional and global data on forests. A pilot study could build on the Global FRA Remote Sensing Survey and on the RSS data already available to do a first approximation of a global estimate of Other Land with TOF.

4. Set the goal and adopt a way forward. In view of the growing importance of TOF issues globally, it is necessary to define clear objectives for a global TOF assessment, like that done for the global assessment of forest resources. This report recommends that the programme responsible for TOF at FAO soon organizes an expert consultation meeting for:

- Refining the seven themes proposed in this report (see Part 1, Table 2) as a basis for the development of a global framework for TOF resources assessment,
- Setting up a step-by-step agenda with realistic targets for further global TOF resources assessments.