What’s in a name? Why forest definitions matter

Sarah Jane Wilson, presenter
Robin L. Chazdon, Pedro H. S. Brancalion, Aoife Bennett-Curry, Kathleen Buckingham, Chetan Kumar, Lars Laestadius, Julian Moll-Rocek, Ima Célia G.Vieira
Pictures of different types of forest.
Primary

Secondary/reforest

Planted

Unplanted

Agroforest
Forest systems transition

Wilson 2014
Forest systems transition

"Forest" (% area)

Time

Primary

Reforest

Total

Wilson 2014
Forest systems transition

Passive
- Regenerating
  - Biodiversity
  - Ecological function

Active
- Plantation
  - Wood
- Agroforest
  - Food, Firewood
  - Sustained yields

"Forest" (% area)

Time

Total

Primary

Wilson 2014
Forest systems transition

**Passive**
- Regenerating
  - Biodiversity
  - Ecological function

**Active**
- Plantation
  - Wood
- Agroforest
  - Food, Firewood
  - Sustained yields

**Time**

A
- Total
  - Reforest
  - Primary

B
- Total
  - Reforest
  - Primary

Wilson 2014
Understanding forests: different paradigms/lenses
What are forests for?

Forest management objectives and paradigms → definitions → policies → quality and extent of forest and non-forest ecosystems.
Forest definitions matter

FOREST is a land bearing vegetative association dominated by trees of any size (FAO 1953). Temporarily unstocked areas and plantations are considered forest.

In 1990 this definition changed to land with tree crown cover (or equivalent stocking level) > 10 % and area of > 0.5 ha with trees > 5 m at maturity (FAO FRA 2000)
FAO, ITTO, IUFRO, FSC
National and regional governments
Maintain state control of forest use

Local stakeholders with expert guidance
Create resilient social and ecological systems through adaptive management
Sustain production of timber and forest products

GFR, WRI, IUCN, FAO
UNCCD, IPBES, UCN, IPCC, UNFCCC, IPBES

Create multi-functional landscapes
Encourage sustainable shifting cultivation and agroforestry

Complex adaptive system
Landscape
Agricultural system

Home
Habitat
Ecosystem services

Ensure that indigenous people can continue their way of life
Maximize potential of forests to store carbon and provide other ecosystem services

UN Permanent Forum on Indigenous Issues
Partners
Forest definitions matter

Forest area ‘increased’ by 300 million ha (10%) between 1990 and 2000 simply because the FAO changed its definition of forest: -

- Height: 7 to 5 m;
- Minimum area: 1.0 to 0.5 ha;
- Crown cover 10%
What is assessed | Actual land cover or forest “state” | Historical context
---|---|---
Total canopy cover | Old-growth forest | Existing forest land
 | Sustainably managed forest | Afforestation
 | Degraded forest | Commercial plantations
 | Restoration plantations |
 | Assisted regeneration | Agroforests
 | Natural regeneration | Trees on farms
 | Commercial plantations | Commercial Plantations
 | Agroforests | Agroforests
Tree cover ( > 30% canopy density), 2000
Tree cover loss 2000 - 2012
Tree cover gain 2000 - 2012
Oil Palm Plantations, 2000 - 2012
Intact forest landscapes 2013
Monoculture tree plantations are often defined as forests

Cryptic destruction of India’s native forests (Puyravaud et al. 2010)
1. an old-growth forest remnant included in a protected area
2. a deforested land for soybean cultivation in the Amazon
3. forest fires and regeneration after disturbance
4. natural regeneration and future return to a pre-disturbance state
5. a shifting cultivation fallow cultivated with cassava
6. restoration plantation in a cropland, some years after deforestation
7. shaded coffee cultivated in an agroforestry system
8. commercial pine tree plantation with dense understory
Forest origins, trajectories, scale, and landscape context matter.
How do we expand our vocabulary to better capture forest realities?

Collaboration is key

People

Tools

Techniques
Tools and techniques

• Better satellite images and innovative remote sensing techniques
Tools and techniques

• Better satellite images and innovative remote sensing techniques
  - Ex: New techniques combine new high resolution images with multi-temporal (older) landsat imagery. (M. Fagan et al. 2015).

• Participatory mapping
  - ...combining “local knowledge, and training of landowners in image interpretation and use of technological tools (satellite images and GPS devices)” to increase land cover classification accuracy.” Vergara-Asenjo et al. (Potvin lab)
  - Collect earth: local forest information can be uploaded from on the ground users
Tools and techniques

• Better satellite images and innovative remote sensing techniques

• Participatory mapping
  - ...combining “local knowledge, and training of landowners in image interpretation and use of technological tools (satellite images and GPS devices)” to increase land cover classification accuracy.” Vergara-Asenjo et al. (Potvin lab)
  - Collect earth: local forest information can be uploaded from on the ground users

• Policy innovation
  - Align forest definitions with management objectives... besides timber.
Global restoration goals

2. Bonn Challenge (2011)

- Restore 150 million hectares of lost and degraded forests by 2020
- 2 billion hectares worldwide
Forest definitions are directly linked to forest “management” paradigms—and in turn to forestry institutions.

For EXAMPLE FAO LINKED TO GERMAN MGMT OBJECTIVES
Forest stewardship: Forests are complex adaptive systems whose resilience is intimately linked with society. Ecosystem services of forests are important for poverty alleviation and sustainable development.

**FOREST** is a land bearing vegetative association dominated by trees of any size (FAO 1953). Temporarily unstocked areas and plantations are considered forest.

In 1990 this definition changed to land with tree crown cover (or equivalent stocking level) > 10 % and area of > 0.5 ha with trees > 5 m at maturity (FAO FRA 2000)

Deforestation: "where the forest is expected to regenerate naturally or with the aid of silvicultural measures within the long-term" (FAO 2001)
In defining the generic scope of the global [forest] assessment, it is assumed that the primary objective of forest assessments is to monitor and assess overall progress in forestry towards sustainable forest management and other political goals at the international level, and to put these efforts in a broader development perspective."
Understanding forests: different paradigms/lenses
forests regenerating largely through a natural process after significant human disturbance of the original forest vegetation has taken place at a single point in time or over an extended period, and displaying a major difference in forest structure and/or canopy species composition with respect to nearby primary forests on similar sites.
Forest trajectories

Intact → Logged → Cleared → Regenerating
To determine whether the removal of trees from an area constitutes deforestation, it is necessary to take into account the likely development of the area. Land continues to be classified as forest if reforestation is to occur in the near future or is already under way, even if the 10 percent canopy cover threshold has not yet been reached. The suggested threshold period is ten years.

(FAO Forest Resource Assessment 2000)
Reforests change over time and space: “landscape framework”

Need to distinguish among types of “refoests”:
• Natural regeneration (second-growth forest)
• Shifting cultivation fallows
• Ecological plantations (restoration)
• Commercial plantations
• Agroforestry
• ...

.... and consider how they interact within landscapes
“...a combination of local knowledge, and training of landowners in image interpretation and use of technological tools (satellite images and GPS devices) as a way to increase accuracy of land cover classification.”

Vergara-Asenjo et al. (Potvin lab)
Forests as land use versus land cover

Land Use
Ex: FAO definition

Land Cover – Tree cover
Ex: Remote sensing, Hansen dataset

Oil palm landscape here
From 2000-2012, most of the global loss of forest occurred in the world's tropical regions.
**Target 15:** By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.
Did you mean: how much forest is being destroyed each year
So reforestat are already prevalent and increasing – recent policies say we need more of them - NEED PHOTO HERE OF CLEARCUT AND REGROWTH – we measure deforestation, but not reforestation.

The way we define forests play a huge role in how we manage them. And the definitions we have are not working for reforests.

The way one views a forest... (PIE)

The functional, structural, and compositional properties of new tree cover differ substantially from those of the forest or non-forest ecosystems they replace (Brown and Zarin 2013) (Tropek et al. 2014), as new tree cover ranges from spontaneous natural regeneration to single-species plantations of non-native trees. But – even though secondary forests are growing in magnitude and importance – they are not easy to measure. In most cases, forest loss is concentrated and abrupt, and can be clearly documented with a sequence of satellite imagery or aerial photos. Forest gain, in contrast, is a highly variable, dispersed, and protracted process that is challenging to document and monitor with commonly used forest definitions and technology (Chazdon 2014).
Forest concepts and definitions influence how we assess and interpret forest transitions—the change over time in the balance between forest loss and forest gain within a geographic region—where both loss and gain are defined in terms of tree canopy cover. Forest gain is not the mirror-image opposite of forest loss. In most cases, forest loss is concentrated and abrupt, and can be clearly documented with a sequence of satellite imagery or aerial photos. Forest gain, in contrast, is a highly variable, dispersed, and protracted process that is challenging to document and monitor with commonly used forest definitions and technology (Chazdon 2014). Differentiating among these different forms of tree cover gain poses a far greater challenge than identifying areas where forest cover has been removed. Widely used forest definitions that perform well for assessing rates of deforestation—as measured by rates of transformation of forest to non-forest land uses—have not proved useful in assessing forest restoration and regeneration.
In this talk, I give a brief historical overview of forest concepts and definitions and link them with distinct perspectives and management. Examples of how forest definitions affect policy. Emphasize the need to distinguish between different types of forests.

In this Perspective, we propose the need for complementary forest definitions to achieve additional management objectives. First, we present a historical overview of forest concepts and definitions and link them with distinct perspectives and management. We discuss forest concepts and frameworks that have motivated different forest definitions over the past three centuries, noting that commonly used definitions created to measure changes in forest stocks have limited utility for assessing and monitoring new and diverse forms of forest cover, which we refer to as "reforests." "Reforests" collectively constitute forest gain, and are increasing dramatically in global importance (Chazdon 2014). We then illustrate how the use of a particular forest definition can influence policy-making, monitoring, and reporting regarding forests, through documented case studies. We emphasize the need to distinguish different types of "reforests" based on their origins, dynamic properties, and landscape settings. We conclude with a call for a more nuanced and diversified approach to defining "reforests" that can distinguish natural from planted forests and forests damaged by logging from second-growth forests, and can be used to track the dynamics of regrowing forest patches within agricultural landscapes.
Figure 3.3. Map of the World's Countries Drawn Proportional to Their Forest Loss

In this depiction of percent forest loss from 1990 to 2000, countries are skewed to be larger if they lost a higher percentage of their forests. An unskewed map is shown to the right.

Global assessments based on national inventory data required harmonization

**FIGURE 7**
Characteristics of the world’s forests, 2010

- Africa
- Asia
- Europe
- North and Central America
- Oceania
- South America
- World

- **Primary**
- **Other naturally regenerated**
- **Planted**
Forest definitions working group (minus two)
Afforestation

"establishment of forest through planting and/or deliberate seeding on land that, until then, was not classified as forest”
FAO (2010, p. 13)

Photo credit: Elisa Salengue
PRESS RELEASE: International campaign to define Forests by their true meaning!

26 March, 2014

International campaign to define Forests by their true meaning!

La Via Campesina, Friends of the Earth International, Focus on the Global South, World Rainforest Movement and more than 120 organizations from around the world sent a letter to the Food and Agriculture Organization of the United Nations, FAO, in Rome, on the occasion of March 21st, the UN International Day of Forest. The letter demands that the FAO change its present definition of forests. During the coming three months, groups will also present the demand to national and regional FAO offices.

Isaac Rojas, coordinator for forests and biodiversity of Friends of the Earth International notes that “FAO's forest definition needs to reflect the cultural wealth that forests represent. The present definition only helps to hide this diversity, rather strengthening a set of false solutions and privatization trends, as well as activities that create negative impacts in the communities that depend on forests”.
The ecological concept of forests as reservoirs of biodiversity gained global importance in the 1970s.

Monitoring and assessment: Frontier forests, intact forests.
**Conservation paradigm:** Intact forests should be protected to conserve biological diversity. Forest management should minimize ecological impact and maximize ecosystem functions and species interactions.

FOREST is a dynamic complex of plant, animal and micro-organism communities and their abiotic environment interacting as a functional unit, where trees are a key component of the system (CBD).
Then came the paradigm of climate change mitigation

Monitoring and assessment: Aboveground biomass, carbon density, carbon storage
Climate Change Mitigation paradigm: Forest conservation, reforestation, and afforestation can reduce global warming through reducing carbon emissions sources and increasing carbon sinks.

FOREST is a minimum area of land of 0.05 – 1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10 – 30 per cent with trees with the potential to reach a minimum height of 2 – 5 meters at maturity in situ (UNFCCC 2001; Kyoto Protocol)

Monitoring and assessment: Aboveground biomass, carbon density, carbon storage
<table>
<thead>
<tr>
<th>Country (year of change in forest definition)</th>
<th>Minimum tree cover (%)</th>
<th>Minimum area (ha)</th>
<th>Minimum tree height (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uganda (2008)</td>
<td>30</td>
<td>1.0</td>
<td>5</td>
</tr>
<tr>
<td>Ghana (2008)</td>
<td>15</td>
<td>0.1</td>
<td>2</td>
</tr>
<tr>
<td>Democratic Republic of Congo (2008)</td>
<td>30</td>
<td>0.5</td>
<td>3</td>
</tr>
<tr>
<td>Rwanda (2008)</td>
<td>10</td>
<td>0.05</td>
<td>3</td>
</tr>
<tr>
<td>India (2008)</td>
<td>15</td>
<td>0.05</td>
<td>2</td>
</tr>
<tr>
<td>Thailand (2007)</td>
<td>30</td>
<td>0.16</td>
<td>3</td>
</tr>
<tr>
<td>Peru (2006)</td>
<td>30</td>
<td>0.5</td>
<td>5</td>
</tr>
</tbody>
</table>
Now: the new paradigm of resilience, restoration, landscapes, and forest stewardship
Stewardship/Resilience Paradigm: Ecosystem services of forests are important for poverty alleviation and sustainable development. People live and work in landscapes, so landscapes are the appropriate units for assessing forests and their functions.

FORESTS are complex adaptive systems whose resilience is intimately linked with society. Forests are complex system composed of heterogeneous assemblages of individual agents (e.g., trees, animals, humans), closely interacting through flows involving markets, goods and various other ecosystem services (Filotas et al. 2014, Chapin et al. 2011).
Global restoration goals
Nagoya, Japan (2010)

Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.
New York Declaration (2014)

Restore 150 million hectares of degraded landscapes and forestlands by 2020 and significantly increase the rate of global restoration thereafter, which would restore at least an additional 200 million hectares by 2030.
Imagine this is the back of a napkin:

Process
ECO. REST.?
REFORESTATION?

S.TATES
LAGRO.
2. HOT. SPEC PLANTATION
SECONDARY FOR.
REST. PLANTING

MIXED NAT. SP. PLANTING
OLD GRANUL

IMARY TO? MINOR. TICE

TIME
The Geo-Wiki Platform

Geo-Wiki is a platform which provides citizens with the means to engage in environmental monitoring of the earth by providing feedback on existing spatial information overlaid on satellite imagery or by contributing entirely new data. Data can be input via the traditional desktop platform or mobile devices, with campaigns and games used to incentivize input. Resulting data are available without restriction.

**Important notice:** Please use Mozilla Firefox or Internet Explorer if possible. In case you want to use Google Chrome, please notice that the NPAPI support (required for the Google Earth plug-in) has been disabled by default in Chrome. Please watch this video to reactivate it. Go to chrome://flags/#enable-npapi to re-enable the browser setting in Chrome.

Get involved

Register to validate existing products, receive newsletters and announcements of new competitions, games, etc., and be eligible for prizes.
monitoring reforestation
Conclusions

• Widely used forest definitions reflect a timber production objective, enabling countries to report zero net deforestation or even forest gain while losing natural forest and grassland ecosystems.

• Definitions that consider the qualities, origins and landscape context of forests are needed to produce balanced policies that protect and restore biodiversity and ecosystem function in both forest and grassland ecosystems.

• Defining and mapping forests based on their historical trajectories produces ecologically meaningful measures of forest change and will help to promote and monitor landscape-level forest restoration.
• New technologies that enable participatory assessment of forest states and trajectories at large spatial scales represent a promising way forward to operationalize new forest concepts and definitions in the era of restoration.

• Contextualized, rather than harmonized definitions, will be needed to support policies to protect, sustain, and regrow forests at national and global scales.
Thank you!
1. **FOREST AND OTHER WOODED LAND**

<table>
<thead>
<tr>
<th>TERM, definition and explanatory notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOREST</strong></td>
</tr>
<tr>
<td>Land spanning more than 0.5 hectares with <strong>trees</strong> higher than 5 meters and a <strong>canopy cover</strong> of more than 10 percent, or trees able to reach these thresholds <strong>in situ</strong>. It does not include land that is predominantly under agricultural or urban land use.</td>
</tr>
</tbody>
</table>

**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.
2. Includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of at least 10 percent and tree height of 5 meters or more. 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 are expected to reach, a canopy cover of at least 10 percent and tree height of at least 5 meters.
6. Includes areas with mangroves in tidal zones, regardless whether this area is classified as land area or not.
7. Includes rubberwood, 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, olive orchards 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.
Fig. 1. (A) Tree cover, (B) forest loss, and (C) forest gain. A color composite of tree cover in green, forest loss in red, forest gain in blue, and forest loss and gain in magenta is shown in (D), with loss and gain enhanced for improved visualization. All map layers have been resampled for display purposes from the 30-m observation scale to a 0.05° geographic grid.
Tropek et al.’s assertion that the results are misleading arises from their failure to recognize the definition explicitly stated of the feature being mapped—forest cover.
Global Forest Watch map shows tree cover gain and tree cover loss.