Forest Cover Analyzer Technical Document

Updated 26 October 2012

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Introduction

The Forest Cover Analyzer enables users to assess forest cover change and associated risks related to sustainable palm oil production. Currently the Forest Cover Analyzer is available for Kalimantan, Indonesia.

Developed by the World Resources Institute (WRI) under Project POTICO, in partnership with Rainforest Alliance, SarVision, University of Maryland, Sekala, and Puter Foundation, the Forest Cover Analyzer allows users to answer three basic questions about any area of their choice in Kalimantan, Indonesia:

- Where and when has forest cover change occurred?
- What is the current extent of forest and peatland?
- How is the area legally classified according to the Ministry of Forestry?

The answers to these basic questions can help producers, buyers, or investors identify risks to sustainable palm oil production.[i] For example, areas with high forest cover change since 2005 or large extents of forest and peatland would pose high risks to a developer hoping to fulfill the Roundtable on Sustainable Palm Oil (RSPO)'s certification requirements. On the other hand, buying from or investing in areas with demonstrated absence of forest cover change could reduce risks for buyers or investors who have made public no deforestation commitments.

Widespread adoption of this application can strengthen efforts to demonstrate achievement of reduced or avoided deforestation goals and to develop financial incentives for sustainable palm oil production in Indonesia. While this initial version was designed to address specific questions facing the palm oil industry and is limited geographically to Kalimantan (Indonesian Borneo), we look forward to working with users to expand its uses and impact.

This document is designed to help you understand how to use the Forest Dover Analyzer and the technical aspects of how it works. The following sections include 1) Overview of Functions and Limitations, 2) How to Use Guide, 3) Methodology, and 4) Data and Specifications.

Please Contact Us[ii] to help us improve your experience with the Forest Cover Analyzer, get more information, inquire about training sessions, contribute case studies, share data, or provide general feedback.

Note: The data used in this application varies in quality and has not been systematically verified. Field assessments and other due diligence activities are necessary to confirm or reject analysis results for use in determining compliance with legal or certification requirements.

Overview of Functions and Limitations

The Forest Cover Analyzer uses spatial and temporal information to allow you to conduct your own investigation on forest cover change, current land cover, and legal classifications in an area of your choice. The Analyzer addresses these three basic questions about the area you have selected:

1) Where and when has forest cover change occurred in the past?

Areas that show tree cover loss in the periods 2006-2007 and 2008-2010 have high risk of not fulfilling RSPO and/or European Union Renewable Energy Directive criteria for palm oil production. A new high resolution (60 meter) dataset of annual tree cover loss, 2001-2010 from the University of Maryland (2012) provides information on past forest cover change. Note: Tree cover loss data does not indicate the causes of forest cover change or necessarily whether there has been deforestation (i.e. a change in land use following the tree cover loss).

2) What is the current extent of forest and peatland?

Areas that show forest cover and wetland are likely to contain high conservation values; to avoid risk of violating RSPO criteria in plantation development, these areas can be avoided or further assessed for appropriate management. A new high resolution (50 m) dataset on Land Cover 2010 from SarVision (2012) provides information on recent forest cover, while the commonly used Wetlands International (2004) dataset provides information on peat extend and depths. Different forest cover classes are categorized according to whether they are similar to "Primary" forest (i.e. having characteristics similar to primary forest) or "Other forest" (likely degraded or secondary forest which likely still contain high conservation values).

3) How is the area legally classified according to the Ministry of Forestry?

Areas that contain protected areas (Hutan Lindung and Hutan Konservasi), production forest (Hutan Produksi Tetap and Hutan Produksi Terbatas), or convertible forest (Hutan Produksi Konversi) legal classifications are likely to face legal risks to oil palm plantation development. Legal classification data is provided by the Indonesian Ministry of Forestry.

In addition, the Analyzer allows you to easily view all of the maps used in the analysis, along with other relevant maps of Kalimantan, such as Aboveground biomass, Land cover 2006 from the Ministry of Forestry, and Primary Forest 2000.

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The Forest Cover Analyzer is designed to be used by a wide variety of actors, including:

- **Investors** who want to minimize the financial and reputational risks associated with deforestation, especially those who have committed to the Equator Principles[iii] or the Roundtable on Sustainable Palm Oil (RSPO).[iv]
- **Palm oil producers** who are seeking sustainable certification, and wish to easily demonstrate achievement of no deforestation goals or maintenance of conservation set-asides.
- **RSPO and auditors** who are working to build the credibility of certification systems and to increase the demand for certified sustainable palm oil.
- **Palm oil buyers** who want to reduce deforestation risks from their supply chains, such as RSPO members or those who have committed to the guidelines laid out by the Consumer Goods Forum.[v]
- **Indonesian national and sub-national government officials** working to achieve Indonesia's ambitious goals for reducing emissions from deforestation and degradation.[vi]

The Forest Cover Analyzer has some limitations, some that are inherent to a large-scale desktop analysis, and others that we will address by continuing to work with stakeholders and partners. Table 2 summarizes these limitations and steps taken to address them.

Table 1: Limitations and Steps to Address

Limitations	Steps to Address
Publicly available concession data may be out of date and may differ from district-level data.	Users can upload or draw custom concession boundaries. Additionally, we welcome user input to provide more accurate or detailed data.
While the Analyzer is appropriate for assessing risks related to compliance with RSPO and/or legal requirements, it is not adequate for proof of compliance on its own.	WRI is actively working in collaboration with the RSPO and Indonesian government agencies to ensure that the Analyzer provides useful information for assessing risks regarding sustainable palm oil production; However, this application is designed to provide only preliminary information. Field assessments and additional due diligence activities are necessary to verify results or determine compliance.
The forest cover change data is updated annually, so there is a lag-time in identifying deforestation risks.	WRI is continuing to work with the University of Maryland to provide updated high resolution annual data when it becomes available. In addition, WRI is working to develop monthly change alerts to be included in a future update.

How to Use Guide

This section describes how to use all the functions of the Analyzer.

After navigating past the Welcome window to the Forest Cover Analyzer screen, a map of Indonesia is displayed on the screen. Kalimantan is in the center of the screen and is currently the only geographic area available for analysis in the Analyzer. Clicking and dragging allows you to move the map. The zoom tool in the upper-left hand corner allows you to zoom in and out.

<u>Dashboard</u>

Located on the right edge of the screen, the Dashboard is the key tool for analysis, as it allows you to manipulate the map and define the criteria that you wish to measure. The Dashboard has two tabs:

- **<u>Explore</u>** allows you to investigate tree cover loss and to explore additional maps. Any changes made in this tab will only affect the map displayed in the Analyzer, not the results calculated.
    - **Tree Cover Change:**
        - **Annual loss**: View annual tree cover change by year. Select start and end dates to be displayed by using the two dots on the slider. Select the play arrow to the right of the slider to watch an animation of tree cover change beginning and ending with the dates selected.
        - **Monthly alerts**: This function is still under development. Use monthly alerts to identify recent (since 2010) and current areas of risk. Unlike estimates for tree cover loss, monthly alerts do not estimate the area of land with forest cover loss, they suggest there is a high probability of loss in a particular area (500 m x 500 m)
    - **More Maps:** Select to view additional maps of Kalimantan. To view tree cover change overlaid with any of the maps in More Maps, select both boxes and adjust the **transparency** slider bar. Table 3 describes the viewable maps (for full data citations, see "Data" section of this document).

Table 2. Viewable Maps available in "More Maps"

Map Title	Description
Land Cover 2010	Land cover 2010 from SarVision (2012, 50 m resolution), classified by type.
Peatland	Peat land in Kalimantan, classified by depth (Wetlands International 2004, 1:250,000 scale).
Aboveground Biomass	Aboveground biomass in tons per hectare as estimated by SarVision (2012, 100 m resolution).
Primary Forest 2000	Primary forest from the year 2000, as defined as "intact forest landscapes" by WRI and Greenpeace (Hansen, 2012, 60 m resolution)[vii]
Legal Classification	Legal classifications, based on Ministry of Forestry categories (Ministry of Forestry, year unknown, 1:250,000 scale): convertible production forest (HPK), limited production forest (HPT), non forestland (APL), production forest (HP), protection forest (HL), conservation forest (KSA-KPA)
Land Cover 2006 – Min Forestry	Land cover in 2006, classified by type. The data is sourced from 2009 Ministry of Forestry data (Ministry of Forestry, 2009, 1:250,000 scale). [viii]

- You can overlay your selected maps with several other map features:
    - **Political boundaries**: Select to display the districts and provinces of Kalimantan
    - **Roads**: Select to show detailed roads, including logging roads.
    - **Rivers:** Select to show rivers
    - **Settlements:** Select to show the main cities of Kalimantan.
    - **Case Studies:** This is under development. We are currently seeking case studies that demonstrate how the Suitability Mapper has been used. In the future, you will be able to select to pinpoint case study locations, showing examples of where the Suitability Mapper has been used for real-world applications.
        - **Contribute Case Study:** Select if you have a case study you would like to share or would like more information about working with us to conduct a case study. This link will direct you to our to our "Contact Us" feedback form.

- **Analyze** lets you define the area you wish to investigate. Once you define the area you are interested in analyzing, the analysis is generated automatically. View the results for an analyzed area by opening the "Summary Results" tab at the bottom of the screen or by using the "Details" button that appears when you select one of the areas on the map or in the table to view additional detailed results of the selected area.

- **Select Areas for Analysis:**
    - i. **My Area of Interest:** Check this box to define a custom area.
        1. **Zoom to:** Find an area for analysis by entering the geographic coordinates for a location in Kalimantan, then selecting "Go" to zoom to that area
        2. **Select a shape:** Select **Circle** or **Rectangle** to quickly draw an area for analysis. Click on the map to begin drawing and let go to finish. Use **Polygon** to draw a more detailed shape. Click on the map to start drawing, click again to define corners, and double click to complete the polygon. Select **Upload** to upload a shapefile containing your sites of interest.
    - ii. **More Areas of Interest:** Select to view pre-analyzed areas of interest on the map
- **More Areas of Interest:** Select to view pre-analyzed areas of interest. Choose the type of area you are interested in from the drop-down box. Options include oil palm, timber, and logging concessions provided by the Ministry of Forestry, and district or province boundaries. Adjust the **transparency** slider bar to make the areas more or less transparent.

Summary Results

The Summary Results box on the bottom of the screen provides a concise summary of results for the selected areas of interest. For example, if districts are selected in the Analyze tab, all the districts in Kalimantan will appear in the Summary Results box.

The Summary Results are organized into three tabs:

- **Change** shows the amount of total tree cover loss in the area of interest in the following three time periods: 2001-2005, 2006-2007, and 2008-2010. Source: University of Maryland, 2012.
- **Forest Cover** shows the amount of recent forest cover in each area of interest in the following three categories: primary, other forest, and wetland. Source: SarVision, 2012, reclassified by WRI.
- **Legal** shows the amount of land in each area of interest that is classified by the Ministry of Forestry as Protected Areas (Conservation Forest and Protection Forest), Production Forest (Limited Production Forest and Production Forest), or Convertible Forest (Convertible Production Forest). Source: Ministry of Forestry, year unknown, reclassified by WRI.

Each tab provides this information for all of the areas of interest selected in the Analyze tab (i.e. My Area of Interest and/or one of the choices in the drop down menu under More Areas of Interest). All units in the Summary Results are areas in hectares (ha). For more information on the data, definitions, and methods used to generate these results, see the Methodology section.

Clicking on the various column headings (name, type, total area, etc.) will sort the districts by that particular heading. Click the **Export** button in the upper-right corner to export your results to an Excel spreadsheet.

Select an area of interest (row) in the Summary Results table to highlight that row in the table and the corresponding shape on the map.

Details

To view more detailed results for each area of interest, select the area on the map. This opens a call out box which shows the Name and Total area of that area of interest. Select <u>delete area</u> to remove the area from the map, or use the pencil icon in the top right corner to rename your Area of Interest.

Open the **Details** button in this call out box to view detailed results. This opens a box in the middle of the screen which has three tabs that correspond to the tabs found in the Summary Results table. The three tabs are:

- **Change** shows the amount of primary forest less, other forest loss, and total tree cover loss in the area of interest in the following three time periods: 2001-2005, 2006-2007, and 2008-2010. In the future, this will also include the number of change alerts within the area. Source: University of Maryland, 2012.
- **Forest Cover** shows the amount of recent forest cover in each area of interest in the following three categories: primary, other forest, and wetland, and also the extent of peatland. Sources: SarVision, 2012, reclassified by WRI; Wetlands International, 2004.
- **Legal** shows the amount of land in each area of interest that is classified by the Ministry of Forestry as Conservation Forest (KSA-KPA), Protection Forest (HL), Limited Production Forest (HPT), Production Forest (HP), Convertible Production Forest (HPK), and Other Land Use (APL). Source: Ministry of Forestry, year unknown.

For more information on the data, definitions, and methods used to generate these results, see the Methodology section. Click the **Export** button in the upper-right corner to export your results to an Excel spreadsheet.

Legend

The Legend box on the bottom right of the screen provides the legend to the map and changes as different layers are added and removed. Click on the **Sources** button in the upper-right hand corner to view a detailed description of the sources used.

Map Tools

The Map Tools box on the left of the screen includes several tools:

- **Overview:** allows you to see where the map is focused in relation to the rest of the Eastern Hemisphere.
- **Print:** allows you to name and print the current map.
- **Draw:** toolbar allows you to draw shapes and label important features directly onto the map:
  - **Point**: allows you to draw dots on the map to highlight areas of interest. Click on the point button and then move the cursor to the place on the map where you want to place a dot. Click the mouse once and a dot will appear.
  - **Line**: allows you to draw a straight line.
  - **Free line**: allows you to draw a line in any shape and direction.
  - **Rectangle:** allows you to create a rectangle or square of any size on the map.
  - **Polygon:** allows you to create a shape with multiple sides. Click and pull the line as many times as needed, and then double click to finish the object.
  - **Move**: allows you to move any drawn object by clicking and dragging the object.
  - **Eraser:** allows you to delete individual objects that you have drawn on the map.
  - **Clear all**: allows you to delete all objects that you have drawn on the map at once.

Banner

The banner on the top of the screen has three purposes:

- The **Basemap** button on the right allows you to choose between different base maps: topographical, a street map, satellite, and a Landsat 2010 map.
- The **English** and **Bahasa Indonesia** radio buttons will allow you to change languages once the Bahasa Indonesia version is available.
- The buttons on the left allow you to navigate away from the Suitability Mapper. The **About** button takes you to the about page for the Forest Cover Analyzer on the WRI website. The **Contact Us** button takes you to our feedback form. The **Download Data** button allows you to download the data that is available.

For more help navigating the Forest Cover Analyzer, a tutorial is under development and will be made available on the About page.

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Methodology

The Forest Cover Analyzer generates results for each Area of Interest using a pre-defined analysis method and set of data relevant to the three categories: Change, Forest Cover, and Legal.

Table 3 describes the calculations and datasets used to generate results for each field in the Summary Results table. Table 4 describes the calculations and datasets used to generate results for each field in the Details for each area of interest. Each of the datasets used are further described in the Data and Specifications section.

Note that there is no single agreed definition of primary forest. In the Forest Cover Analyzer, the term primary forest should be understood as a proxy for areas that are likely to contain forests with characteristics similar to primary forests, and therefore are likely to contain high carbon stock and high conservation values. When using different datasets the Forest Cover Analyzer uses "primary forest" to refer to the best approximation of these areas according to that dataset. Therefore, technically different definitions are used for primary forest in the Change tab (using the Primary Forest 2000 dataset from University Maryland 2012 created according to intact landscapes definition), and the Forest Cover tab (using SarVision 2012 land cover map reclassified by WRI). We welcome improved datasets with clear definitions of primary and other types of forest.

Table 3. Summary Results Methodology: Field Descriptions and Data Used			
Tab	**Field**	**Description**	**Data Used**
All	Name	For My Areas of Interest, name is automatically generated and can be changed by the user. For concessions, name of company. For districts or provinces, name of district or province. For districts, provides [Province name] district.	Oil palm concessions, Timber concessions (HTI), Logging concessions (HPH), Political boundaries (Ministry of Forestry, year unknown; Minnemeyer, 2009).
	Type	Identifies whether is user generated (My Areas(s) of Interest), a concession (Oil palm, logging, or timber), or a political boundary (district of province).	Oil palm concessions, Timber concessions (HTI), Logging concessions (HPH), Political boundaries (Ministry of Forestry, year unknown; Minnemeyer, 2009).
	Total Area (ha)	Total area in hectares	Calculated from user input, Oil palm concessions, Timber concessions (HTI), Logging concessions (HPH), Political boundaries (Ministry of Forestry, year unknown; Minnemeyer, 2009).
Change	Tree Cover Loss (ha): 2001-2005	Sum of all annual tree cover loss that has occurred in the years 2001-2005.	Annual tree cover loss 2001-2010 (University of Maryland, 2012).
	Tree Cover Loss (ha): 2006-2007	Sum of all annual tree cover loss that has occurred in the years 2006-2007.	Annual tree cover loss 2001-2010 (University of Maryland, 2012).
	Tree Cover Loss (ha) : 2008-2010	Sum of all annual tree cover loss that has occurred in the years 2008-2010.	Annual tree cover loss 2001-2010 (University of Maryland, 2012).
Forest Cover	Forest Cover (ha): Primary Forest	Sum of the areas of the following classes: closed canopy forest, closed canopy forest occurring over peat soils, open canopy with trees occurring over peat soils, and mangrove forests. **Note: Includes secondary forests with primary forest-like characteristics. This primary forest definition is different from that of Primary Forest 2000.**	Land cover 2010 (SarVision 2012)
	Forest Cover (ha): Other Forest	Sum of the areas of the following classes: degraded secondary forest with canopy closure of up to 30% occurring in flat lands with dry terrain, secondary forest regrowth with open canopy vegetation and canopy closure of at least 30%, and riparian forests.	Land cover 2010 (SarVision 2012).
	Forest Cover (ha): Wetland	Sum of the areas of the following classes: Wetland.	Land cover 2010 (SarVision 2012).
Legal	Legal classification (ha): Protected Areas	Sum of areas classified as any type of Hutan Konservasi and areas classified as Hutan Lindung (HL)	Legal classification (Ministry of Forestry, year unknown).
	Legal Classification (ha): Production Forest	Sum of areas classified as Hutan Produksi Terbatas (HPT) and Hutan Produksi Tetap (HP)	Legal classification (Ministry of Forestry, year unknown).
	Legal Classification (ha): Convertible Forest	Area classified as Hutan Produksi Konversi (HPK)	Legal classification (Ministry of Forestry, year unknown).

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Table 4. Details Methodology: Field Descriptions and Data Used			
Tab	**Field**	**Description**	**Data Used**
Change	Tree Cover Loss 2001-2005: Primary	Sum of annual tree cover loss that occurred on Primary forest 2000 in the years 2001-2005.	Annual tree cover loss 2001-2010, Primary forest 2000 (University of Maryland, 2012).
	Tree Cover Loss 2001-2005: Other Forest	Sum of annual tree cover loss that occurred outside of Primary forest 2000 in the years 2001-2005.	Annual tree cover loss 2001-2010, Primary forest 2000 (University of Maryland, 2012).
	Tree Cover Loss 2001-2005: Total	Sum of all annual tree cover loss that occurred in the years 2001-2005.	Annual tree cover loss 2001-2010 (University of Maryland, 2012).
	Tree Cover Loss 2006-2007: Primary	Sum of annual tree cover loss that occurred on Primary forest 2000 in the years 2006-2007.	Annual tree cover loss 2001-2010, Primary forest 2000 (University of Maryland, 2012).
	Tree Cover Loss 2006-2007: Other Forest	Sum of annual tree cover loss that occurred outside of Primary forest 2000 in the years 2006-2007.	Annual tree cover loss 2001-2010, Primary forest 2000 (University of Maryland, 2012).
	Tree Cover Loss 2006-2007: Total	Sum of all annual tree cover loss that occurred in the years 2006-2007.	Annual tree cover loss 2001-2010 (University of Maryland, 2012).
	Tree Cover Loss 2008-2010: Primary	Sum of annual tree cover loss that occurred on Primary forest 2000 in the years 2008-2010.	Annual tree cover loss 2001-2010, Primary forest 2000 (University of Maryland, 2012).
	Tree Cover Loss 2008-2010: Other Forest	Sum of annual tree cover loss that occurred outside of Primary forest 2000 in the years 2008-2010.	Annual tree cover loss 2001-2010, Primary forest 2000 (University of Maryland, 2012).
	Tree Cover Loss 2008-2010: Total	Sum of all annual tree cover loss that has occurred in the years 2008-2010.	Annual tree cover loss 2001-2010 (University of Maryland, 2012).
	Change Alerts 2011-2012: Number of Alerts	These are coming soon.	Currently unavailable
Forest Cover	Forest Cover: Primary Forest	Sum of the areas of the following classes: closed canopy forest, closed canopy forest occurring over peat soils, open canopy with trees occurring over peat soils, and mangrove forests. **Note: this includes secondary forests with primary forest-like characteristics. This primary forest definition is different from that of Primary Forest 2000.**	Land cover 2010 (SarVision 2012)
	Forest Cover: Other Forest	Sum of the areas of the following classes: degraded secondary forest with canopy closure of up to 30% occurring in flat lands with dry terrain, secondary forest regrowth with open canopy vegetation and canopy closure of at least 30%, and riparian forests.	Land cover 2010 (SarVision 2012).
	Forest Cover: Wetland	Sum of the areas of the following classes: Wetland.	Land cover 2010 (SarVision 2012).
	Peatland	Sum of all areas with peat of any depth.	Peatlands (Wetlands International, 2004).
Legal	Conservation Forest (KSA-KPA)	Area classified as any type of Hutan Konservasi	Legal classification (Ministry of Forestry, year unknown).
	Protection Forest (HL)	Area classified as Hutan Lindung (HL)	Legal classification (Ministry of Forestry, year unknown).
	Limited Production Forest (HPT)	Area classified as Hutan Produksi Terbatas (HPT)	Legal classification (Ministry of Forestry, year unknown).
	Production Forest (HP)	Area classified as Hutan Produksi Tetap (HP)	Legal classification (Ministry of Forestry, year unknown).
	Convertible Production Forest (HPK)	Area classified as Hutan Produksi Konversi (HPK)	Legal classification (Ministry of Forestry, year unknown).
	Other Land Use (APL)	Area classified as Areal Pengunaan Lain (APL)	Legal classification (Ministry of Forestry, year unknown).

Data and Specifications

In designing the Forest Cover Analyzer, WRI aimed to maintain the highest standard of quality possible in terms of ease of use and accuracy and accessibility of data.

Ease of Use

- The Analyzer is intended for use by a general audience with no prior knowledge of spatial analysis (GIS) software or other technical expertise.

- To ensure a positive user experience, the Analyzer went through an extensive internal review process to refine its design and data organization. Additionally, the Analyzer was tested by relevant experts and potential users, generating feedback and suggestions that were used to further improve the user interface. More than 100 stakeholders were interviewed concerning the usability of the Analyzer and their comments were incorporated into the final version.

- The Forest Cover Analyzer can be accessed at http://www.wri.org/applications/maps/forest-cover-analyzer/index.html by anyone with an internet connection and a web browser (e.g. Internet Explorer, Firefox, Google Chrome). It requires Adobe Flash Player which can be downloaded for free here: http://get.adobe.com/flashplayer/.

Accuracy of Data

- The data underpinning the Analyzer has its limitations, especially the concession boundary data. However, every effort has been made to collect data from the most credible sources. The sources for forest cover change and current forest cover, The University of Maryland and SarVision, are internationally recognized as being on the cutting edge of remote sensing efforts.

- Field surveys were conducted by the Puter Foundation at more than 300 sites in Kalimantan, in order to verify results of the forest cover change data.

Accessibility of Data

- Whenever possible, we have made the data underpinning the Analyzer publically available. Many of the original data sets used are publically available for download here.[1]

- Note: Data for "Tree cover change 2001 -2010" and "Primary forest 2000" produced by the University of Maryland is not yet available for public download. To access "Landcover 2010" and "Aboveground Biomass" data, please contact Niels Wielaard of SarVision at wielaard@sarvision.nl.

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[1] http://www.wri.org/project/potico/about-forest-cover-analyzer

- The Forest Cover Analyzer calculates area statistics from existing datasets without further manipulation. In some cases the original classes in the original datasets were reclassified into broader categories by WRI (e.g. Land cover 2010 classes provided by SarVision). Where this has been done has been described above.

- The application is written using Adobe Flex which is an open source framework for building applications for the browser, desktop and mobile devices.

- The results of the Forest Cover Analyzer were verified by manually comparing the analysis results for a selected sample of concessions and districts using ArcGIS and the results generated automatically by the Forest Cover Analyzer.

Table 3. Data Descriptions and Sources

Title	Description	Source
Land Cover 2006 – Min Forestry	This layer shows 2006 land cover, classified by type. The data is sourced from 2009 Ministry of Forestry data (1:250,000 scale). Land cover categories correspond to those from the Ministry of Forestry data: airport/harbor; bare land; bodies of water; dry rice land; dry rice land mixed with scrub; fish pond; HTI; mining; plantation; primary dry land forest; primary mangrove forest; primary swamp forest; rice land; savannah; srubland; secondary dry land forest; secondary mangrove forest; secondary swamp forest; settlement; swamp; swamp srubland; transmigration area Exact definitions and descriptions of the methodologies used to produce this data are not available.	Ministry of Forestry Indonesia (2009). Land cover Indonesia 2006. Forestry Planning Agency of the Ministry of Forestry, 2009. Interpretation of 2005 and 2006 Landsat images. Provided and processed by Greenpeace. Prepared by the World Resources Institute (2012).
Land Cover 2010	This layer shows the land cover for 2010 based on SarVision analysis (2012). Recent ALOS PALSAR radar satellite imagery at 50m spatial resolution were processed and used to produce annual land cover map series covering all of Kalimantan (East, South, Central and West Kalimantan) for 2009 and 2010. Supervised classification techniques were applied using field observations and information from other optical satellite imagery as training data sets. MODIS 250m and Landsat 30m resolution satellite imagery were processed and used as reference data. - A total of 17 vegetation structural types were detected to be different in the coastal zones and the interior of Kalimantan using supervised classification techniques over the radar images. The World Resources Institute consolidated several of the SarVision categories for use in the Forest Cover Analyzer (2012) .Categories include: closed forest; secondary forest; peat forest; riparian forest; wetland; mangrove; grassland; shrubland; dryland agriculture; plantation; bare area; water.	SarVision (2012). Prepared by the World Resources Institute (2012).
Peatlands	This layer shows the peatland in Kalimantan, classified by depth (1:250,000 scale). Depth categories (in cm): 0, <50, 50-100; 100-200; 200-400; 400-800; 800-1200. Dataset was digitized by Sekala (a local non-profit organization), atlas of peat land distribution Kalimantan (Wetlands International, 2004). Maps are available digitally online at <http://www.wetlands.or.id/publications_maps.php>. This dataset was prepared by the World Resources Institute for use in the Interactive	Wetlands International (2004). Data available in Minnemeyer et al. (2009). Interactive Atlas of Indonesia's Forests CD-ROM. Washington, DC: World Resources Institute. Prepared by the World Resources Institute (2012).

Atlas of Indonesia's Forests (2009).

Aboveground Biomass	This layer shows the above ground biomass in tons per hectare as estimated by SarVision (2012, 100 m resolution). A two step approach was used for biomass mapping integrating. Alos PALSAR images and ICESat-GLAS derived height data over a wide area. Above ground biomass map can not be accounted directly as a carbon map. For a more complete carbon content estimation the below ground biomass needs to be accounted as well as the biomass contributions by dead wood and litter.	SarVision (2012). Prepared by the World Resources Institute (2012).
Primary Forest 2000	Shows primary forest from the year 2000, based on Landsat imagery (30 m resolution). Intact forest landscapes as defined by WRI and Greenpeace, correspond to "primary" forest in 2000. See http://www.intactforests.org/ for further defintions regarding intact forest landscapes.	Hansen, M. (2012). University of Maryland. Prepared by the World Resources Institute (2012).
Tree cover change, 2001-2010	Tree cover loss to <30% canopy cover for each year 2000-2010. 60 m resolution, using combination of Landsat and MODIS satellite imagery. Each year starts in November – so "2006" is November 2005- October 2006. All change that took place on forest classified as "Intact Forest 2000" was designated as primary forest cover loss.	Hansen, M. (2012). University of Maryland. Prepared by the World Resources Institute (2012).
Legal Classification	This layer shows legal classification, based on Ministry of Forestry categories (1:250,000 scale): • convertible production forest (HPK) • limited production forest (HPT) • non forestland (APL) • production forest (HP) • protection forest (HL) • conservation forest (KSA-KPA)	Ministry of Forestry Indonesia (year unknown). Kawasan Hutan (Forest Estate) land use maps, General Direktorat of Planning, Ministry of Forestry. Downloaded from http://appgis.dephut.go.id/appgis/kml.aspx in March 2010, with maps for Riau and Central Kalimantan downloaded in March 2011. Processed and provided by Greenpeace. Prepared by the World Resources Institute (2012).
Logging Concessions (HPH)	This layer shows logging concessions with data from the Ministry of Forestry.	Ministry of Forestry Indonesia (year unknown). IUPHHK_HA (logging concessions), provided by the Planning Department of the Ministry of Forestry, Indonesia (Direktorat Jenderal Planologi Kehutanan, Kementerian Kehutanan Republik Indonesia). Google Earth Format Downloaded from: http://appgis.dephut.go.id/appgis/kml.aspx July 30 2010. Provided and processed by Greenpeace. Prepared by the World Resources Institute (2012).
Timber Concessions (HTI)	This layer shows timber concessions with data from the Ministry of Forestry.	Ministry of Forestry Indonesia (year unknown). IUPHHK_HT (timber plantation concessions), provided by the Planning Department of the Ministry of Forestry, Indonesia (Direktorat Jenderal Planologi Kehutanan Kementerian Kehutanan Republik Indonesia). Google Earth Format Downloaded from: http://appgis.dephut.go.id/appgis/kml.aspx downloaded September 2010. Updated using 1) MoFor (2010) Pemanfaatan Hutan, Data dan Informasi, Tahun 2010, Ministry of Forestry Indonesia, November 2010 www.dephut.go.id/files/Buku pemanfaatan 2010.pdf and 2) MoF (2011), online WebGis Kehutanan, online interactive map http://webgis.dephut.go.id/ditplanjs/index.html accessed May 12 2011. Processed and provided by Greenpeace. Prepared by the World Resources Institute (2012).

Oil Palm Concessions	This layer shows oil palm concessions with data from the Ministry of Forestry.	Ministry of Forestry Indonesia (year unknown). Perkebunan (Agriculture plantations). Direktorat Jenderal Planologi Kehutanan, Kementerian Kehutanan Republik Indonesia, downloaded as Google Earth files (kml) from http://appgis.dephut.go.id/appgis/kml.aspx accessed 29 July 2010, supplemented with data gathered from provincial planning agencies (BPN). Processed and provideed by Greenpeace (2011). Prepared by the World Resources Institute (2012).
Political Boundaries	This dataset, prepared for use in the Interactive Atlas of Indonesia's Forests (2009), displays the provinces and districts Kalimantan. It was generated by WRI using the provinces dataset produced by Badan Pusat Statistik (BPS) in 2003.	Badan Pusat Statistik (BPS-Statistics Indonesia). Data available in Minnemeyer et al. (2009). Interactive Atlas of Indonesia's Forests CD-ROM. Washington, DC: World Resources Institute. Prepared by the World Resources Institute (2012).
Rivers	The downloadable dataset is a combination of rivers and lakes prepared by WRI. Rivers: This data displays the rivers of South East Asia, originally produced by Bakosurtanal, the Indonesian National Coordinating Agency for Surveys and Mapping. It was prepared by WRI for use in the Interactive Atlas of Indonesia's Forests (2009) Lakes: GLWD-1 and GLWD-2, prepared for use in the Interactive Forestry Atlas of Indonesia (2009), displays the largest lakes and reservoirs of Indonesia. This dataset is a subset of the global product called the Level 1 Global Lakes and Wetlands Database (GLWD), produced by the World Wildlife Fund (WWF). It comprises the shoreline polygons of the largest lakes (area >= 50 square km) and reservoirs (storage capacity >= 0.5 cubic km) worldwide, including extensive attribute data.	Prepared by World Resources Institute (2012).Rivers: Barkosurtanal, http://www.bakosurtanal.go.id Bakosurtanal, the Indonesian National Coordinating Agency for Surveys and Mapping. Data available in Minnemeyer et al. (2009). Interactive Atlas of Indonesia's Forests CD-ROM. Washington, DC: World Resources Institute. Lakes: Bernhard Lehner and Petra Doell. World Wildlife Fund US, Washington DC, USA. Center for Environmental Systems Research, University of Kassel, Germany. The original GLWD database may be accessed online at http://www.worldwildlife.org/science/data/item1877.html.
Roads	This dataset displays detailed roads for Indonesia. It comes from the basemaps of Indonesia, developed by Bakosurtanal. The time period corresponds to the 2003 situation of roads including logging roads. This dataset was prepared by the World Resources Institute for use in the Interactive Atlas of Indonesia's Forests (2009).	Bakosurtanal, the Indonesian National Coordinating Agency for Surveys and Mapping. Data available in Minnemeyer et al. (2009). Interactive Atlas of Indonesia's Forests CD-ROM. Washington, DC: World Resources Institute. Prepared by the World Resources Institute (2012).
Settlements	This dataset displays the main cities of Kalimantan. It is a subset of the Gridded Population of the World (GPW), Global Rural-Urban Mapping Project (GRUMP), Aplha version 1: settlement points. This data also provides with population counts of the settlement points for 2000, 1995, 1990. The World Resources Institute prepared this dataset for use in the Interactive Atlas of hte Indonesia's Forests (2009). The original GRUMP data was produced by the Socioeconomic Applications and Data Center (SEDAC) of Center for International Earth Science Information Network (CIESIN) at Columbia University. The original data are available from the SEDAC website, <http://sedac.ciesin.columbia.edu/gpw> .	Center for International Earth Science Information Network (CIESIN) at Columbia University. Data available in Minnemeyer et al. (2009). Interactive Atlas of Indonesia's Forests CD-ROM. Washington, DC: World Resources Institute. Prepared by the World Resources Institute (2012).
Population Density	This data displays the population density per square kilometer. It is a subset (for Indonesia) of the Gridded Population of the World, version 3 (GPWv3). This dataset was prepared by the World Resources Institute for use in the Interactive Atlas of Indonesia's Forests (2009). The original dataset is available from CIESIN here, <http://sedac.ciesin.columbia.edu/gpw/>. Gridded Population of the World, Version 3 (GPWv3) consists of estimates of human population for the years 1990, 1995, and 2000 by 2.5 arc-minute grid cells and associated datasets dated circa 2000. The data products include population count grids (raw counts), population density grids (per square km), land area grids (actual area net of ice and water), mean administrative unit area grids, centroids, a national identifier grid, national boundaries, and coastlines. These products vary in GIS-compatible data formats and geographic extents (global, continent [Antarctica not included], and country levels). A proportional allocation gridding algorithm, utilizing more than 300,000 national and sub-national administrative units, is used to assign population values to grid cells. GPWv3 is produced by the Columbia University Center for International Earth Science Information Network (CIESIN) in collaboration with Centro Internacional de Agricultura Tropical (CIAT).	Center for International Earth Science Information Network (CIESIN) at Columbia University, in collaboration with Centro Internacional de Agricultura Tropical (CIAT). Data available in Minnemeyer et al. (2009). Interactive Atlas of Indonesia's Forests CD-ROM. Washington, DC: World Resources Institute. Prepared by the World Resources Institute (2012).

Acknowledgements

The POTICO team would like to acknowledge the following partners for all of their contributions to the Forest Cover Analyzer: Rainforest Alliance, SarVision, University of Maryland, Sekala, and Puter Foundation. The POTICO team would also like to acknowledge the contributions of the following past and present WRI staff to the production of the Forest Cover Analyzer: Ariana Alisjahbana, Jessica Darmawan, Pascal Douard, Beth Gingold, Duncan Gromko, Lisa Johnston, Andrew Leach, Moray McLeish, Rauf Prasodjo, Anne Rosenbarger, Fred Stolle, and Therese Tepe.

This application was designed with Blue Raster and is powered by ESRI.

Project POTICO has received generous support from: NewPage Corporation, Walmart, Johnson & Johsnon Family of Consumer Companies, The Netherlands Ministry of Foreign Affairs, The Swedish International Development Cooperation Agency, The United Kingdom Climate Change Unit Indonesia, and the International Finance Corporation - Biodiversity and Agricultural Commodities Program. The International Finance Corporation is not responsible for the implementation or administration of this project.

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End Notes

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[i] "Sustainable" production as per a set of sustainability guidelines such as those formulated by the Roundtable on Sustainable Palm Oil and the

[ii] http://wri.org/project/potico/contact

[iii] The Equator Principles are a set of guidelines for investors who wish to invest in a socially and environmentally responsible manner. "[Equator] Principles are intended to serve as a common baseline and framework for the implementation by each [financial institution] of its own internal social and environmental policies, procedures and standards related to its project financing activities." The Analyzer is particularly helpful for addressing principle 2, which requires a "social and environmental assessment" of all projects. For more information, see: http://www.equator-principles.com/

[iv] The Roundtable on Sustainable Palm Oil "unites stakeholders from seven sectors of the palm oil industry," with the objective of: "…promoting the growth and use of sustainable oil palm products through credible global standards and engagement of stakeholders." For more information, see: http://www.rspo.org/

[v] The Consumer Goods Forum is a group of over 400 retailers, manufactures, service providers, and other stakeholders whose vision is: "Better lives through better business." The Forum has set the goal of zero net deforestation by 2020 from all activities in their commodity supply chain. For more information, see: http://www.theconsumergoodsforum.com/index.asp

[vi] The moratorium prohibits new concessions in primary natural forest and peatland areas. For analysis of the moratorium, see: http://www.wri.org/publication/indonesia-moratorium-on-new-forest-concessions or http://www.cifor.org/online-library/browse/view-publication/publication/3561.html

[vii] See http://www.intactforests.org/ for further defintions regarding intact forest landscapes.

[viii]The World Resources Institute reclassified the original land cover categories from the Ministry of Forestry dataset for use in the Suitability Mapper into the following categories:

- Primary dry land forest, primary mangrove forest, primary swamp forest --> "primary forest"
- Secondary dry land forest, secondary mangrove forest, secondary swamp forest --> "secondary forest"
- Swamp, swamp scrubland --> "wetland"
- Bare land, savannah, scrubland --> "grassland/shrub"
- HTI, plantation --> "plantations"
- Dry rice land, dry rice land mixed with scrub, rice land, fish pond --> "agriculture"
- Mining, airport/harbor, settlement, transmigration area -->"settlements/other land use"
- Bodies of water, cloud --> excluded