# GENERATION OF A MAXIMUM YEARLY LAI DATABASE FOR FORESTS

Project code SO-TN-TV-GS-0002-1.a

Version 1

Date 10/03/2006

| | ***Role*** | ***Name*** | ***Date and signature*** |
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# DOCUMENT STATUS SHEET

| version / Rév. | Date | Pages | Changes | Visa |
|---|---|---|---|---|
| 1.a | 10/03/2006 | | | |
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# ACRONYMS

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# 1. General information

For 30" x 30" pixels covered by forests, the LAI values were derived using the Ecoclimap software, downloaded by

http://www.cnrm.meteo.fr/gmme/PROJETS/ECOCLIMAP/page_ecoclimap.htm

selecting " October 04 DATABASE "

The software, as well as the relevant data base, are described in the document entitled "Ecoclimap2: A new approach at global and European scale for ecosystems mapping and associated surface parameters database using SPOT/VEGETATION data – First results", written by Jean-Louis Champeaux, Kyung-Soo Han, Denis Arcos, Florence Habets, and Valery Masson, Proceedings of IGARSS 2004.

The data base gives fundamental vegetation parameters, including LAI, and was obtained following three fundamental steps.

1. First of all, world pixels were classified according to recent land cover maps. At global scale, GLC2000 (Bartolomé and Belward, 2004) was adopted, with the support of the regional legends associated to the Land Cover Classification System (LCCS) developed by FAO, that allows to characterize precisely the vegetation at 1km resolution (Bartolomé, 2003). Over Europe, the updated CORINE 2000 product, with 250m resolution, was used.

2. The second step was to split land cover classes into more homogeneous sub-classes ("ecosystems"). To this aim, the information contained in multi-annual S10 NDVI SPOT/VEGETATION was used. An unsupervised and/or hierarchical classification process, applied to multi-annual (1999-2003) S10 NDVI SPOT/VEGETATION profiles, made it possible to discriminate different behaviours inside each land cover class. The classification was performed for each land cover class, each pixel being defined by its NDVI 10-day time-series (1999-2003). An automatic algorithm determined the optimised number of clusters for each GLC2000/CORINE class. In a second step, the mean NDVI profile was computed and analysed for each cluster. The spatial coherence of the classes was checked and, if necessary, a regrouping of the classes having a similar NDVI profile was carried out. Application of this method to Africa led to define 90 "ecosystems", starting from 24 GLC2000 classes.

3. Finally, vegetation parameters were derived from the ecosystems defined previously. Over natural areas, each ecosystem was truncated into fractions of woody vegetation, herbaceous vegetation and bare soil. The database must allow for both the surface 'tile' and the classical aggregated approaches. The parameter

aggregation procedure described by Noilhan and Lacarrere (1995) was carried out.

## 2. LAI information

The Leaf Area Index (LAI) is defined as the surface area of leaves contained in a vertical column normalized by its cross-sectional area. It is important to consider not only its seasonal variation, but also its regionalism according to climates, because of the vegetation dynamics.

The actual variability of the vegetation parameters within each ecosystem (according to the definition given in the previous Section) can be reasonably assumed to be weak spatially, even if it is large temporarily. From this, it is legitimate to derive a set of biophysical properties per ecosystem. A number of studies have demonstrated the close relationship between the LAI and NDVI (Asrar et al. 1984; Baret and Guyot 1991). Then LAI is obtained according to the following rules:

a) Pure ecosystems

Each pure ecosystem includes a single vegetation type with a corresponding LAI. Note that the understory LAI is incorporated for the forests. Due to the lack of a unique relationship between LAI and NDVI, this NDVI information serves to make a dynamic adaptation of the LAI from the minimum and maximum values found in the literature:

$$LAI=LAI_{min} + (LAI_{max}-LAI_{min}) * (NDVI-NDVI_{min}) / (NDVI_{max}-NDVI_{min}) \quad (1)$$

b) Mixed ecosystems

Each mixed ecosystem can include one herbaceous vegetation type and/or one woody vegetation type. Therefore, LAI must be defined for both of them. Two cases must be distinguished.

over Northern America, Eastern Europe, Central Russia, and South-East Asia, the woodland and wooded grassland UMd land covers represent transitions between crops and forest : then, the LAI of the dominant crop (forest) ecosystem in the area is assigned to the herbaceous (woody) vegetation type of the mixed ecosystem.

for a landscape composed of trees and natural herbaceous vegetation, and possibly bare soil, like from equatorial forests to tropical deserts and from boreal forests to tundra, a similar procedure to the pure ecosystems is applied for each type of the mixed ecosystem. The LAI time profile is then given by the NDVI time profile. This holds for all vegetation types of the ecosystem. Their temporal cycles can no longer be discriminated.

# 3. Output files

Using the Ecoclimap software, the files "lai.01.t002.001.intg" and "lai.07.t002.001.intg" were generated. The files are ASCII. Each file is of 11 Giga-Bytes.

They include LAI values for all 30" x 30" pixels of the earth surface, for January and July.

January values are contained in "lai.01.t02.001.intg" and must be interpreted as maximum yearly values (LAI_MAX in TGRD) for the lower hemisphere.

July values are contained in "lai.07.t02.001.intg" and must be interpreted as maximum yearly values (LAI_MAX) for the upper hemisphere.

The files dimensions are: 21600 latitude rows * 43200 longitude columns. LAI values are given in sequence, starting from +90 latitude and -180 longitude.

For each 30" x 30" pixel, an integer is stored, which gives: LAI * 10. For most of pixels which are not FFO, the integer is fixed to 255.