



E.O. Support to the Kyoto Protocol

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Objective

- Explore the potential of EO in Kyoto protocol establishment
- Based on an ESA-funded project called TESEO carbon (project number 15557/01/I-LG), consortium:
 - VTT (Finland) coordinator
 - Gamma remote sensing (Switzerland) partner
 - European Forest Institute (Finland & International), partner
 - Stora Enso Forest Consulting (Finland), partner
- In TESEO Carbon project, the forest ecosystems are considered to be the most important to look at (ESA has a parallel project on wet-land protection treaties).



Relevant issues to remote sensing in Kyoto protocol

- Kyoto Protocol principal regulation:
 - **Man-made** greenhouse gas emission reduction by 5 percent from the 1990 level (for most developed countries) during first commitment period from 2008 to 2012
 - Clean Development Mechanism for developing countries
- What has to be monitored:
 - Carbon storage
 - Carbon sequestration (from 1990 to 2008-2012)
 - Carbon loss (from 1990 to 2008-2012)
 - Carbon trade

Priority Applications Groups

- Land cover/land use including tree species group
- Carbon stock - Biomass estimation
- Change monitoring
 - continuous change (biomass accumulation: afforestation, reforestation)
 - rapid change (deforestation, forest cutting/fire scar)
- Harmonized information with an unbiased manner at national scale

Top four target variables from the user survey

- Area of forest
- Land use classes (for the base year, i.e. normally 1990)
- Area of afforestation, reforestation and deforestation
- Above-ground vegetation biomass and its changes
- Illegal use of nature conservation areas (especially around Clean-Development-Mechanism project areas)
- Selected using priorities and user confidence to the potential of Earth Observation
- Geographic unit of the mapping should be 1 hectare or preferably smaller



Core results of literature search on EO potential

| Theme | No. | Notes |
|---------------------------------|-----|--|
| Land cover | 50 | Semi-operative approaches exist, validation not systematic, calibration procedure usually needed, accuracy 80 to 90 percent |
| Change monitoring of land cover | 19 | Main application clear cutting, deforestation, and fire scar mapping with an accuracy of 80 to 90 percent, also SAR coherence and multi-temporal SAR backscatter |
| Forest biomass estimation | 18 | Potential at lower biomass values up to 100 tonnes/ha (170 m ³ /ha) – at higher level saturation problem (both optical and SAR) |
| Forest biomass change | 8 | Close to land cover change – blurred message |
| Tree species | 2 | Possible at conifer/broadleaved tree level – mixed forests problematic |



Conclusion from Surveys

- Presently no direct products for Kyoto Protocol enforcement exist
- User organizations consider EO one data source that is combined with field data
 - Combination alternatives:
 - transforming statistical data into map data using EO
 - EO alarms on suspicious targets in which field inventory data and EO data conflict
 - True synergistic use of EO and field inventory - validation a problem
- Base year (1990)
 - no new ground reference data can be collected
 - satellite data sources are limited
- Spatial resolution of (optical) Envisat instruments inadequate?
- Product chains that output several products the main focus in the future development?