



GFOI R&D Plan for 2015+

An action plan for advancing priority R&D topics related to the use of Remote Sensing in National Forest Monitoring

Version 1.1

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
1. R&D COMPONENT ACTIVITIES AND OUTCOMES IN 2013/2014.....	5
1.1 R&D Coordination	5
1.2 Review of Priority R&D Topics	6
1.3 Landscaping study	6
1.4 Establishment of a research programme	7
1.4.1 Expert workshop series	7
1.4.2 Research groups and study sites.....	8
1.4.3 Satellite data	8
1.4.4 Reporting	9
1.5 Connections with other GFOI components 2013/2014	9
1.5.1 Space Data Coordination Group.....	9
1.5.2 Methods and Guidance Documentation component.....	9
1.5.3 Capacity Building	10
1.5.4 Inter-relationships	10
2. IMPLEMENTATION PLAN for 2015.....	11
2.1 GFOI R&D programme	11
2.1.1 Scope	11
2.1.2 Expert Workshop series.....	11
2.1.3 Data acquisition in support of R&D (Element-3 Plan).....	11
2.1.4 Science and result presentation meeting.....	12
2.1.5 Communication and reporting.....	12
2.2 On-going integration with other GFOI components	12
2.2.1 Space Data Coordination Group.....	12
2.2.2 Methods and Guidance Documentation Component.....	13
2.2.3 Capacity Building	13
2.2.4 Inter-relationships	13
3. CONTINUITY of the R&D COMPONENT.....	15
ANNEX A – GFOI R&D investigators and Study Sites	17

EXECUTIVE SUMMARY

The GFOI R&D Programme *identifies priority areas* for research and development targeted at *improving* and *operationalising* of inputs to support emissions estimation and reporting.

As new sensors and related capabilities emerge, new methodologies are developed to use these in management and monitoring of forest systems. The conventional forest data products of tomorrow's measurement, reporting and verification (MRV) reports are today's areas of research and development. GFOI has developed an R&D plan which identifies priority areas where research is required to achieve its goals. Identified priorities include: forest degradation, mapping of particular forest types (mangrove, peat forests, etc.), interoperability, comparison of uncertainties associated to different forest biomass and allometrics estimation methodologies, data model integration.

The research focuses on progressing priority R&D topics to an operational status for integration in future revision and development of the GFOI Methods and Guidance Documentation (MGD) resources. The MGD aims at delivering robust technical solutions integrating remote sensing and ground based observations for the estimation of emissions and removals of greenhouse gases in forests.

Key outcomes from the R&D component thus far include:

- Of most significance is the release of the 'Review of Priority Research & Development Topics' (Dec, 2013), which identifies the operational status of key remote sensing derived forest map products needed by countries as they establish their National measurement, reporting and verification Systems (MRV), and the additional, prioritised R&D that is needed to improve the accuracy and reliability of each product.
- Completion of a 'Landscaping study' (July, 2014) that maps out priority R&D topics against the interests of potential research and partner organisations and identifies possible funding sources for them.
- Organisation of three expert workshops that provided a forum for identifying actions to progress specific R&D topics towards operational use. Workshop topics included Sensor Interoperability (June, 2014), Forest Degradation (Oct, 2014) and Vegetation Biomass Estimation (Feb, 2015).
- Support to the (parallel) development of the SDCG Element-3 Strategy, which is a coordinated multi-sensor data acquisition strategy dedicated to support GFOI priority R&D.
- Identification of relevant forest map products and R&D needs/issues in collaboration with the MGD component. With the common mandate of continuous improvement of MRV systems, the results of the R&D programme will be incorporated in future revisions of the MGD.
- An assessment of country R&D needs in collaboration with the Capacity Building component (SilvaCarbon). SilvaCarbon has supported the organisation of expert workshops and participation of developing country representatives. Country specific needs are built into the R&D Programme.

In addition, the R&D component has fostered relationships with external organisations such as GOF-C-GOLD and FAO, who have similar overarching objectives.

With the limited resources of the former GFOI Office for R&D, the GFOI R&D coordination group set out to capitalize on on-going and already funded research through a series of focused expert workshops and preparations for the initiation of a research programme to progress priority R&D topics towards operationalisation. This includes close liaison with the SDCG in its development of the Element-3 strategy, which outlines CEOS agency contributions (free of charge data acquisitions/provision) in support of GFOI priority R&D.

Specific R&D needs were expressed by GFOI countries and identified through expert workshops and former contacts of the GEO Forest Carbon Tracking (FCT) programme. Together with the R&D Review, these form the drivers for the GFOI R&D Programme and SDCG Element-3 Strategy which is being developed in parallel with it.

The outcomes of the R&D Programme are aimed to serve the MGD and Capacity Building components of GFOI by helping deliver robust and cost-efficient methods that satisfy UNFCCC requirements and enable continuous improvement of MRV systems in developing countries.

As the role of GFOI Office as lead for the GFOI R&D component was discontinued by the end of January 2015, the GFOI leads rapidly need to consider new viable solutions relating to its leadership. Assuming that pending structural and funding issues for the R&D component will be resolved without further delay, implementation of the R&D Programme in 2015 is foreseen as follows:

- Subject to CEOS endorsement of the SDCG Element-3 Strategy at SIT-30, satellite observations in support of GFOI priority R&D are foreseen to commence in the 2nd quarter of 2015. Space agencies have already expressed their willingness to undertake new acquisitions and supply archive data at no cost to researchers. Access to satellite data over nominated GFOI study sites is provided on the basis of the commitment of research teams to process and analyse the data and contribute to reporting and communication of results.
- Participating research groups are required to undertake the relevant analysis and communicate outcomes at annual/biennial science meetings and in technical reports. Research groups are also encouraged to publish in scientific peer-reviewed journals. R&D results will be assessed for possible inclusion in future revisions of the MGD.
- Further identification of priority R&D topics and demonstration activities through joint Expert workshops with GFOI partners and inclusion in the R&D Programme.
- Closer collaboration between the R&D component and other GFOI components, in particular, the MGD, to ensure operational methods/approaches arising from the R&D Programme and external sources are considered for inclusion in the MGD and training material.

1. R&D COMPONENT ACTIVITIES AND OUTCOMES IN 2013/2014

Section 1 outlines the organisation of the R&D component and the activities and outcomes of the GFOI R&D programme in 2013/14. The drivers and key components of the programme are described, including the R&D Review, expert workshops, coordination of research groups, study sites and supply of satellite data. The inter-relationships between the R&D and other GFOI components (SDCG, MGD and Capacity Building) and external agencies (GOFC-GOLD, FAO) are discussed.

1.1 R&D Coordination

The GFOI R&D component was in 2012-2013 lead by the Norwegian Space Centre, and in 2014 the GFOI Office, supported by a group of external experts (referred to below as the *R&D Coordination Group*). As of January 2015, there is no Lead or funding for the R&D component.

R&D Coordinator: Ake Rosenqvist (soloEO, Tokyo, Japan)

Funding 2014: GFOI Office

Responsibilities: Support the GFOI office in managing the R&D component; organisation of regular R&D component teleconferences between GFOI office and R&D coordination group; lead revision of R&D plan for 2015+; lead organisation of expert workshops; coordinate research teams and R&D activities; co-draft technical reports and review papers. As SDCG co-chair (2011-2014), responsible for the development of the SDCG Element 3 strategy.

R&D Co-coordinator: Anthea Mitchell (University of New South Wales, Sydney, Australia)

Funding 2014: GFOI Office

Responsibilities: Support the GFOI office in managing the R&D component; co-draft R&D plan; assist in organisation of expert workshops; assist in coordinating R&D activities; lead drafting of technical reports and review papers; undertake science scanning (continuous review of operational methods developed outside of GFOI R&D programme) and update of R&D Review. Support the SDCG co-chair with the development of the SDCG Element 3 strategy

R&D Advisor: Alex Held (CSIRO, Canberra, Australia)

Funding: CSIRO

Responsibilities: Provide advice in the development of the R&D component; assist in organisation of expert workshops.

1.2 *Review of Priority R&D Topics*

The *GFOI Review of Priority R&D Topics* was published by the GFOI in December 2013. It covers those remote sensing derived forest map products outlined in the GFOI Methods and Guidance document, which are needed by countries as they establish a MRV System, deciding if they are operational, pre-operational or are still in an R&D phase, and considering what additional R&D is needed to improve them.

The Review identifies current gaps and opportunities for improving the accuracy and reliability of each product. The research needs have been prioritised to highlight those most urgently needed by countries to implement practical MRV that comply with IPCC Good Practice Guidance (GPG).

The priority topics as identified in the R&D Review constitute the drivers for the R&D programme.

- The highest research priorities are those that address:
 - Proxy methods for reporting degradation and/or enhancement of carbon stocks;
 - Time-series consistency;
 - Satellite sensor interoperability; and
 - Stratification for generating activity data and degradation products.
- Medium research priorities address the generation and continual improvement (by use of time-series consistency and satellite sensor interoperability) of:
 - Forest/non-forest and land use change,
 - Early warning systems; and
 - Degradation type products.
- Newer techniques, such as above ground biomass estimation, were in the review rated as of lower priority, but this may change as new technology becomes available and the methods mature.
- Priority capacity building needs as identified by GFOI countries are included in the MGD, and include, for example, time-series consistency, satellite sensor interoperability and proxy methods.

The *GFOI Review of Priority R&D Topics* is available from the GFOI website:
http://www.gfoi.org/sites/default/files/GFOI_ReviewPriorityRDTopics_V1.pdf

1.3 *Landscaping study*

The *GFOI Landscaping study* was released in July 2014 and it provides a review of current research activity worldwide as linked to GFOI priority R&D topics. The Landscaping study identifies R&D that is on-going and will progress without external funding, the shortfalls in current research that will require additional funding, and potential GFOI partner organisations who may contribute to technical advancement of products/technologies or financing thereof.

It was anticipated that the Landscaping Study would form the basis of consultation with potential research and contributing partners and the development of specific R&D proposals of mutual benefit. Without further resources, this avenue for funding GFOI priority research will not be realised.

If, in future, joint studies are considered relevant to the R&D and SDCG Element-3 plans, our recommendation is for funding support to progress strategy discussion with potential partner organisations on research topics and priorities, influence calls for proposals and coordinate the response from international research teams.

The Landscaping Study is available for download at:

https://dl.dropboxusercontent.com/u/45615793/R%26Dlandscaping_July2014.pdf

1.4 Establishment of a research programme

Preparations for the establishment of a research programme started in 2014 with the ultimate aim to progress the priority R&D topics towards an operational status for incorporation in future revisions of the MGD. It is intimately linked with the SDCG Element 3 strategy, where the former provides the framework for management of research groups, study sites, reporting and science meetings and workshops, and the latter the framework for the acquisition and provision of relevant satellite data.

With no GFOI budget available to directly fund research groups to undertake dedicated R&D of relevance to GFOI however, the approach has been to aim to capitalise on and catalyse already on-going R&D of relevance to GFOI and encourage focus on operational status through:

- Dedicated expert workshop series that focus on specific priority topics
- Invitation of research groups to participate in the research programme, and identification of a limited number of dedicated study sites
- Liaison with the SDCG in their establish of a programme for acquisition and provision of relevant space data (i.e. the SDCG Element-3 strategy) in support of GFOI priority research; with subsequent management of research activity by the R&D coordination group
- Follow-up of results and progress through release of regular status reports and organisation of annual/biennial R&D-oriented result presentation meetings (science summits).

These activities are discussed in detail below. The timeline in Table 1 (page 13) includes a summary of R&D activities and outcomes in 2013/2014.

1.4.1 Expert workshop series

To kick-start R&D activities, a series of technical expert workshops were initiated in 2014 to capitalise and catalyse already on-going external research and to establish contacts with leading research groups and country organisations. The workshops focused on selected Priority R&D Topics and involved a small number of key experts on the topics in question.

The objectives of each workshop are as follows:

- Assessment of existing approaches and current state of the art for the topic in question;
- Identification of obstacles to operational (widespread) use;
- Development of an action plan to progress development;
- Input/recommendations to CEOS space agencies (Element-3 strategy)

Three expert workshops have been organised/planned so far:

- Expert workshop 1 – Sensor interoperability/complementarity
Woods Hole, MA/USA, June 10-11 2014
- Expert workshop 2 – Forest degradation (organised jointly with GOF-C-GOLD)
Wageningen, The Netherlands, Oct. 1-3, 2014
- Expert workshop 3 – Vegetation biomass estimation (organised jointly with GOF-C-GOLD and CSIRO/TERN)
Brisbane, Australia, Feb. 24-26, 2015

Detailed workshop reports are available at the GFOI R&D website:

http://www.gfoi.org/sites/default/files/GFOI_RDExpertWS1_Report_final.pdf

http://www.gfoi.org/sites/default/files/GFOI-GOF-C-GOLD_RDExpertWS2_Report.pdf

1.4.2 Research groups and study sites

Through the expert workshops and through contacts with researchers and country representatives involved in the GEO-FCT National Demonstrator programme (2009-2011), to date, a team of 11 groups have expressed interest in participating in the GFOI R&D programme.

Some 30 sites have been nominated as GFOI R&D Study sites – see Annex A. The sites are mostly located in sub/tropical regions, and high priority is given to research groups that involve local country contacts.

1.4.3 Satellite data

In parallel with the R&D programme establishment, the SDCG has progressed the development of the Element-3 strategy, which is dedicated to supporting GFOI R&D activities with dedicated space data. Specifically, this includes data that are not available through the SDCG baseline strategy (Element-1). Space agencies with commercial or semi-commercial missions (ASI, CSA, CNES, DLR, JAXA) have expressed willingness to undertake new acquisitions and/or provide archived data, at no cost to participating research groups, over a limited number of study sites defined under the GFOI R&D programme.

To this end, the R&D coordination group has during 2014 liaised closely with the SDCG in the development of the SDCG Element-3 Strategy. The arrangement provides mutual benefits for GFOI, space agencies and research groups through:

- Improved understanding on how satellite acquisition strategies should be defined in order to optimise the usefulness of the data (e.g., to detect and monitor degradation)

- Improved understanding on the usefulness of multi-sensor data (sensor synergy) in forest monitoring
- Increased awareness and promotion of the use of space data through inclusion of case studies in the MGD
- Support for targeted research that addresses key science and/or operational issues for specific satellite missions.

Requests for EO data and nominations of R&D Study sites were compiled during and following the R&D Expert workshops and provided to SDCG for consideration in the Element-3 strategy, together with detailed R&D objectives for each research team and each study site. This information is included as an Annex of the SDCG Element-3 document. The requests were subsequently coordinated by SDCG into a single observation plan that simultaneously aims to address several GFOI priority R&D topics.

1.4.4 Reporting

It is acknowledged that the R&D programme will need to include means for adequate reporting of progress and outcomes (described below in section 2.1). The R&D teams will be responsible not only for processing data but also for sharing and communicating results through participation at dedicated result presentation meetings – suggested to be organised on an annual or biennial basis starting in late 2015/early 2016 – and contribution to annual technical reports and publications. There are expected to be significant benefits from communication, as well as those arising from free provision of satellite data over the GFOI study sites.

1.5 Connections with other GFOI components 2013/2014

The R&D coordination group have been active in establishing links between the R&D component and the SDCG, MGD and Capacity Building components. The nature of these linkages are outlined below.

1.5.1 Space Data Coordination Group

As described in section 1.4.3 above, the R&D Plan and the SDCG Element-3 Strategy are being developed in parallel so that the two components form a single integrated plan. The R&D component relies on the space data to be provided through the Element-3 Strategy and in turn, the SDCG and the CEOS space agencies contribute on the condition that analyses are undertaken under GFOI coordination and results and progress are adequately communicated on a regular basis.

1.5.2 Methods and Guidance Documentation component

The recommended forest map products defined in the MGD (MGD, Table 6) were jointly identified by the MGD and R&D coordination groups. The R&D Review document formed the basis of the discussions on the recommended forest map product specifications, their operational status, and R&D needs and priorities, and so contributed to the development of the MGD. In addition, the section of the MGD on Synthetic Aperture Radar applications (MGD 3.2.4) was authored by the R&D group.

On advice from the GFOI Leads, the MGD and R&D coordination groups drafted a summary report that clarified the links between the R&D Plan and the MGD, and described key R&D needs and priorities. The report was targeted at Government agencies to increase awareness of priority research topics and so influence calls for funding/proposals. The report is available at

https://dl.dropboxusercontent.com/u/45615793/Priority-MGD-RD-Summary_DRAFT.pdf.

MGD representatives (Jim Penman, Carly Green) participated in the 2nd and 3rd Expert Workshops on Forest Degradation and Vegetation Biomass, respectively. Invitations to future workshops will be extended.

1.5.3 Capacity Building

GFOI aims to provide on-going technical assistance to countries as they develop their MRV Systems. Through the Capacity Building and the SDCG groups, the R&D coordination group has worked with a number of countries to assess their immediate and longer-term data and R&D needs. SilvaCarbon regional workshops and SDCG country consultation days have been organised, not only to provide hands-on training and expert guidance, but also provide a forum for countries to define their R&D needs.

The three R&D Expert workshops undertaken to date have all been organised with the support of the GFOI Capacity Building component lead (SilvaCarbon) and country representatives have participated to share their experiences.

The country specific R&D needs are aimed to be taken into account in the R&D programme. Topics for the expert workshops are identified on the basis of this country-level input, as well as knowledge gained through the R&D Review and discussions between the R&D coordination group and other stakeholders. R&D activity under the SDCG Element-3 strategy also encourages participation of developing countries. As the new methods reach maturity and are suitable for operational forest monitoring, it is anticipated that they will be integrated in technical guidance and future training sessions.

1.5.4 Inter-relationships

The R&D coordination group have also established connections with other GFOI stake holders such as GOFC-GOLD. Given similar over-arching objectives, a close collaboration between the R&D group and GOFC-GOLD is mutually beneficial. The 2nd and 3rd R&D Expert workshops have been organised jointly with GOFC-GOLD.

Communication with the FAO has also been maintained, with representatives from the UN-REDD programme (Erik Lindquist, Andrew Haywood) participating in the 2nd and 3rd Expert workshops. The GFOI R&D programme directly aims to serve the FAO as they strive to progress methods to operational status and build country capacity in MRV systems.

2. IMPLEMENTATION PLAN for 2015

This section outlines the proposed implementation plan for the R&D programme in 2015. Continuation of the expert workshops is proposed, and satellite data acquisitions and provision are anticipated to commence by SDCG agencies, with subsequent increase in research activity. Closer relationships with the other GFOI components are anticipated to ensure that the results of the R&D are integrated into the MGD and Capacity Building programmes.

2.1 GFOI R&D programme

2.1.1 Scope

The GFOI R&D Programme is being developed to address priority R&D topics as identified in the R&D Review and by countries themselves. It builds on the previous GEO Forest Carbon Tracking (FCT) National Demonstrator activities and engages the scientific community through expert workshops and country organisations already involved in relevant R&D.

The main objective of the R&D programme is to serve the MGD and Capacity Building components. As new technologies and methodologies related to the GFOI Priority R&D Topics are proven suitable for operational forest monitoring and satisfy UNFCCC reporting requirements, they should be included in technical advice given to countries as they prepare and improve their MRV systems.

The continued development of the R&D programme in 2015 will focus on further liaison with the SDCG in the development of the Element-3 Strategy in support of the R&D programme, further collaboration through expert workshops and science meetings, and closer collaboration with the MGD and Capacity Building components.

The timeline in Table 1 (page 13) includes proposed R&D activity in 2015.

2.1.2 Expert Workshop series

Given the limited budget required and high level of output achieved, the expert workshops undertaken thus far in 2014-2015 have proven to be a cost-effective means of engaging experts and country representatives working in the field of forest monitoring and REDD+. Based on the positive feedback from participants as to the usefulness of the events, it is proposed to schedule additional workshops in 2015 on outstanding key priority topics, again co-organised with GOF-GOLD whenever feasible.

The National Commission on Biodiversity of Mexico (CONABIO) has expressed interest to host an expert workshop in mid/late 2015 on R&D topics of relevance to Latin American governmental stakeholders.

The scheduling of future expert workshops will be made known to all GFOI component groups. Subsequent summary reports will be available on the GFOI R&D website.

2.1.3 Data acquisition in support of R&D (Element-3 Plan)

Given the basic structural interrelationship between the GFOI R&D programme and the SDCG Element-3 strategy, it should be noted that neither can be undertaken without the other. But assuming that the pending structural and financial issues relating to the GFOI R&D component can be resolved in a timely manner, the SDCG Element-3 is planned to be submitted to CEOS for

endorsement at SIT-30 in early April, 2015, and dedicated satellite data acquisitions are foreseen to commence in the second quarter of 2015.

The GFOI R&D programme will continue to be developed in parallel with the SDCG Element-3 strategy and the inclusion of new R&D sites in the Element-3 Plan may be considered where there is active participation of developing countries. Site and EO data requests will be collected at future expert workshops and country consultation days. These will be integrated into the Element-3 strategy wherever practicable, subject to mission planning constraints/normal operations.

2.1.4 Science and result presentation meeting

To assure regular reporting of progress and outcomes, an annual or biennial science and result reporting meeting is proposed as part of the R&D programme. Similar to the Science and Data Summit (SDS) meetings organised in USA 2010, Italy 2011, Tanzania 2012 under GEO-FCT, and in Australia 2013 for the GFOI. The objectives of the proposed GFOI science meetings would be to share results and outcomes with GFOI stake holders (country representatives, CEOS agencies, leads), assess methods for possible inclusion in the MGD, and foster collaboration amongst GFOI components and participating countries. The first GFOI R&D science meeting is proposed for late 2015/early 2016, depending on the progress of data distribution and R&D. The R&D coordination group will assume responsibility for the organisation of such a meeting, including venue hire and logistics, email invitations, and liaising with GFOI Office for support of developing country participation.

2.1.5 Communication and reporting

An annual technical report on R&D outcomes will be published and shared with space agencies and GFOI participants (similar to the GEO-FCT National Demonstrator technical reports¹). This will provide assurance to space agencies that the satellite data are being used as intended. A more active GFOI website is anticipated, where research outcomes and opportunities are advertised.

A technology review paper on Forest Degradation mapping methods is being drafted by the R&D coordination group, with contributions anticipated from workshop participants. The paper describes state-of-the-art methodologies for the detection and monitoring of forest degradation, and identifies the gaps and R&D needs for their continuous improvement. The article will be submitted to an open access journal in 2015. Clearance for publication will be sought with Leads as required.

2.2 On-going integration with other GFOI components

2.2.1 Space Data Coordination Group

The R&D coordination group will continue to liaise with the SDCG (who will liaise with CEOS space agencies) and ensure communication and sharing of results from the R&D programme as described in sections 2.1.4 and 2.1.5 above. SDCG and CEOS representatives will be invited to future expert workshops and R&D science meetings and will have opportunity to engage with researchers and provide feedback on active R&D studies.

¹<http://www.geo-fct.org/pd-team-documents>

2.2.2 Methods and Guidance Documentation Component

The importance of maintaining the link to the MGD and developing a closer relationship between the R&D coordination group and MGD group to facilitate contributions to MGD is recognised. Communication is key, in the form of regular teleconferences, and invitations extended to MGD representatives to attend future expert workshops and annual science meetings.

Close collaboration with the MGD component is anticipated in future as new technologies become available and, through the R&D Programme, methods mature to a level that satisfies UNFCCC requirements and country needs for robust and cost-efficient means of measuring, reporting and verifying REDD+ activities.

A process of incorporating the results of the R&D programme into the MGD should be developed. The contributions from workshop participants, annual technical report and case studies/methodologies are the steps to realising the integration of the R&D and MGD components.

As R&D relevant that is to the MGD also can be anticipated to be undertaken elsewhere in the world, independent of the GFOI R&D programme, it is intended that the R&D coordination group also undertake 'science scanning', or a continuous assessment of current scientific literature, project reports and other sources for identification of potential methods and approaches that have progressed from R&D to operational status (beyond those arising from the GFOI R&D programme) for possible inclusion in the MGD. The R&D coordination group will consult with the MGD Lead on this.

2.2.3 Capacity Building

The interface between the R&D and Capacity Building components will assist in strengthening relationships with country contacts and encourage wider adoption of GFOI. By developing closer relationships with countries, better understanding of their R&D needs will be gained. The future participation of GFOI countries at expert workshops and annual science meetings is anticipated.

Greater collaboration is foreseen between the R&D coordination group, MGD and capacity building groups, so that the latest technologies are incorporated in technical documentation and training programmes.

2.2.4 Inter-relationships

A closer link with GOFC-GOLD is anticipated during 2015. Given the similarities in structure with the GFOI R&D component, a closer collaboration with GOFC-GOLD would be mutually beneficial through sharing country contacts, driving the R&D programme and priority research topics, organising joint expert workshops, and implementing capacity building/training programmes. The outcomes of the R&D programme are directly relevant to the GOFC-GOLD Sourcebook and other training material being prepared.

Table 1. R&D activities and outcomes in 2013/2014 and proposed R&D activity in 2015.

Task Quarter	2013				2014				2015			
	1	2	3	4	1	2	3	4	1	2	3	4
Drafting of 'Review of Priority Research & Development Topics'	■	■										
Peer review period for Review Document		■	■									
Peer review of MGD Document			■									
Final release of MGD v1 (Dec 2013)				●								
Final release of ' Review of Priority Research & Development Topics ' (Dec 2014)				●								
GFOI R&D Plan (Feb, 2014)					●							
1st GFOI R&D Expert Workshop: Sensor Interoperability						●						
Completion of ' Landscaping Study '(July, 2014)							●					
GFOI R&D Plan (July, 2014)							●					
Drafting ' GFOI Research Priorities - Summary ' report with MGD coordinator Carly Green							●					
2nd GFOI R&D Expert Workshop: Forest Degradation								●				
Draft GFOI R&D Plan for 2015									●			
3rd GFOI R&D Expert Workshop: Vegetation Biomass Estimation									●			
Support to drafting of ' CEOS SDCG Element-3 Strategy '							■	■	●			
Collation of user requests for sites and satellite data for 'Element-3 Strategy'							■	■				
GFOI Leads Meeting , Sydney Seek endorsement of R&D Plan									■			
Satellite observations under Element-3 Strategy commence										■		
' Science scanning ' and integration in MGD in collaboration with Australia											■	●
4th GFOI R&D Expert Workshop TBD											■	
First GFOI Science Meeting TBD												■
Annual Technical Report on status of R&D activity under Element-3 for SDCG to report to CEOS												●

3. CONTINUITY of the R&D COMPONENT

Continuity of the R&D component without further gap is paramount to its success and successful integration with other GFOI components, in particular the MGD. Adequate resources are required to manage the R&D Programme and coordinate with other GFOI components. Strategic action at the GFOI Leads level is needed to promote the R&D component and ensure the necessary support and linkages.

The following key activities are foreseen in 2015:

1. R&D component management

- Component management and planning. Coordination with R&D Component Lead.
Deliverables: R&D Plan revisions, monthly teleconferences
Timeframe: Continuous during 2015

2. Initialisation and coordination of R&D activities in parallel with SDCG Element-3 strategy implementation

- Establishment of agreements with R&D teams outlining responsibilities and time schedules
- Interface between research teams and SDCG agencies contributing to Element-3
Deliverable: Research agreements and input to SDCG Element-3 Strategy revisions
Timeframe: Continuous during 2015

3. Manage participating (external) research teams and coordinate reporting and communication of results to space agencies and other GFOI components.

- Deliverable: Technical report on R&D outcomes
Timeframe: Annually Q4

4. Coordinate Expert workshops

- Coordinate at least one Expert workshop on key Priority R&D Topics during 2015
Tentative host: CONABIO, Mexico
Timeframe: Q3 2015 (TBC)
Deliverable: Expert workshop and summary reports

5. Update of *GFOI Review of Priority R&D Topics*

- Continuous review of scientific literature and reports (i.e., 'science scanning') for methods and approaches that are considered operational, or indeed used in an

operational context, and that have been developed outside of the GFOI R&D programme.

Deliverable: Revised R&D Review document and collaboration with MGD coordinators for possible inclusion of mature methods in the MGD.

Timeframe: Annual

6. Liaison with other GFOI components

- Liaison with the SDCG, MGD and Capacity Building components to improve awareness of, and encourage their input to the R&D programme, and facilitate contributions to the MGD and future training programmes.

Deliverable: Teleconferences

Timeframe: Continuous during 2015

ANNEX A – GFOI R&D investigators and Study Sites

Country	Site name	Site Code	Research group	R&D Topics						Sensors requested			
				LU & activity data	Deforestation	NRT change	Stratification	Degradation	AGB & change	Optical	VHR Optical	SAR	
Brazil	Mato Grosso	BRA-1	Group 1					X					
C. African Rep.	Mbaiki	CAR-1	Group 2		X		X	X					
Gabon	Gabon	GAB-1			X	X	X	X					
Colombia	Pacifico-Bajo_Mira	FCT-COL-3	Group 3	X	X			X					
	Amazonia-Tinigua	FCT-COL-4		X	X			X					
	Andes-Antioquia	FCT-COL-5		X	X			X					
	Caqueta	COL-6		X	X			X					
	La Victoria	COL-7											
Ethiopia	Kafa BR	ETH-1	Group 4		X	X		X					
Fiji	Lololo & Nakavu	FIJ-1			X	X							
Peru	Peru	PER-1			X	X		X					
Guyana	GFC-1	FCT-GUY-1	Group 5					X					
	GFC-2	FCT-GUY-2						X					
	GFC-3	FCT-GUY-3						X					
Indonesia	Mawas	FCT-BOR-3	Group 6	X				X	X				
	Harapan	FCT-SUM-2						X	X				
Tanzania	Amani	TNZ-5	Group 7		X				X				
	Liwale	TNZ-6			X				X				
Papua New Guinea	Kokoda	PNG-1	Group 8		X			X	X				
	Milne bay	PNG-2			X			X	X				
	Yus	PNG-3											
Mexico	Chiapas-1	FCT-MEX-2	Group 9	X	X			X	X				
	Durango	MEX-8			X				X				
Finland	Hyytiälä	FIN-1			X				X				
	Sodankylä	FIN-2			X				X				
Iceland	Hallormsstadur	ICE-1			X				X				
Russia	Pechora-Ilych	RUS-1			X				X				
Australia	Mathinna	FCT-AU-1		Group 10	X				X	X			
	Takone	FCT-AU-2			X				X	X			
	Warra	FCT-AU-3						X	X	X			
	Robson Creek	AU-4					X	X	X				
	Injune	AU-5											

Canada	NW Territories	CAN-1	Group 11	X	X		X		X			
	NW Territories	CAN-2		X	X		X		X			
Indonesia	Central Kalimantan	KAL-1	Group 12					X	X			
	South Sumatra	SUM-1		X	X			X	X			
Brazil	Novo Progresso	BRA-2		X	X			X	X			
Suriname	Kabo	SUR-1			X	X	X	X	X			
Indonesia	Malinau	MAL-1			X	X	X	X	X			
Madagascar	Mahafaly	MAD-1			X	X	X	X	X			
South Africa	Lowveld/Kruger N.P.	SA-1		Group 13				X	X			
	Eastern Cape	SA-2					X	X				

List of R&D groups:

R&D Group 1:

Organisation: INPE (Brazil)
Principal Investigator: Y. Shimabukuro
Study Sites: Mato Grasso (BRA-1), Brazil

R&D Group 2:

Organisation: SIRS (France)
Principal Investigator: C. Sannier
Study Sites: Mbaïki (CAR-1), Central African Republic (GAB-1), Gabon

R&D Group 3:

Organisation: Boston University, Woods Hole Research Center (USA)
Principal Investigator: P. Olofsson, J. Kellendorfer
Study Sites: Pacifico-Bajo Mira (FCT-CO-3), Amazonia-Tinigua (FCT-COL-4), Andes-Antioquia (FCT-COL5), Caqueta (COL-6), La Victoria (COL-7), Colombia

R&D Group 4:

Organisation: Wageningen University (The Netherlands)

Principal Investigator: M. Herold, J. Reiche

Study Sites: Kafa BR (ETH-1), Ethiopia, (PER-1), Peru, Lololo and Nakavu (FIJ-1), Fiji

R&D Group 5:

Organisation: Guyana Forest Commission (Guyana), Indufor (Asia Pacific)

Principal Investigator: P. Bolanath, P. Watt

Study Sites: Guyana Forest Commission Site 1 (GFC-1), Site 2 (GFC-2),
and Site 3 (GFC-3), Guyana

R&D Group 6:

Organisation: Wageningen University (The Netherlands)

Principal Investigator: D. Hoekman

Study Sites: Mawas, Kalimantan (FCT-BOR-3), Harapan, Sumatra (FCT-SUM-2),
Indonesia

R&D Group 7:

Organisation: KSAT, NMBU, UiT, NLI, Norut (Norway)

Principal Investigator: A.K. Debien, E. Næsset, S. Anfinsen, S. Solberg, J. Haarpaintner,

Study Sites: Amani (FCT-TNZ-5), Liwale (FCT-TNZ-6), Tanzania

R&D Group 8:

Organisation: HGC (Malaysia)

Principal Investigator: M. Williams

Study Sites: Kokoda (PNG-1), Milne Bay (PNG-2), Yus (PNG-3), Papua New Guinea

R&D Group 9:

Organisation: VTT (Finland)

Principal Investigator: T.Häme

Study Sites: Chiapas-1 (FCT-MEX-2), Durango (MEX-8), Mexico

Hyytiälä (FIN-1), Sodankylä (FIN-2), Finland

Hallormsstadur (ICE-1), Iceland, Pechora-Ilych (RUS-1), Russia

R&D Group 10:

Organisation: CSIRO, UNSW (Australia)

Principal Investigator: N. Sims, A. Held, A. Mitchell, R. Lucas

Study Sites: Mathinna, Takone and Warra, Tasmania (FCT-AU-1, -2, -3),
Robson Creek, Queensland (AU-4), Injune (AU-5), Australia

R&D Group 11:

Organisation: Natural Resources Canada, Canadian Forest Service (CFS, Canada)

Principal Investigator: A. Beaudoin, R. Hall

Study Sites: Northwest Territories (CAN-1), (CAN-2), Canada

R&D Group 12:

Organisation: RSS, Humboldt University, Airbus DS Geo GmbH (Germany)

Principal Investigator: F. Siegert, P. Hostert, F. von Poncet

Study Sites: Central Kalimantan (KAL-1), South Sumatra (SUM-1), Indonesia,
Novo Progresso (BRA-2), Brazil, Kabo (SUR-1), Suriname,
Malinau (MAL-1), Indonesia, Mahafaly (MAD-1), Madagascar

R&D Group 13:

Organisation: CSIR (South Africa)

Principal Investigator: R. Mathieu

Study Sites: Lowveld/Kruger N.P. (SA-1), Eastern Cape (SA-2), South Africa