

# Activities and research priorities related to Early Warning Forest Monitoring GFOI R&D Coordination Component 2018

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The GFOI R&D team attended the GFOI International Forum on Forest Early Warning (EW) Systems in Lima, Peru, 9-10 July 2018<sup>1</sup>. Participants included the research community, space data providers, early warning system developers, and a wide array of government and civil society data users. Already the R&D component identified early warning forest monitoring systems as a priority R&D topic<sup>2</sup>. Based on the discussions of the forum in Lima, and results from a user needs assessment<sup>3</sup>, key priorities for R&D were identified on this theme, based on a better understanding of country needs.

## Early Warning research needs

We identify sequential questions EW system users need to answer to effectively respond to EW data, from the remote sensing based identification of new change, to decision making and taking action. These sequential questions are based on the five steps of typical EW systems (Fig. 1, and *Finer et al. Science 360, 6395, 1303-1305*), which are (1) the detection of the change (where and when change happened), then (2) prioritization of the data, which is also based on (3) information on why it happened, or the driver of change. Finally, users need to decide whether action is needed, so (4) this information needs to be effectively communicated so that (5) actions which can reduce deforestation can be implemented.

## What Happens When an Alert is Triggered?



[bit.ly/EWsystems](https://bit.ly/EWsystems)



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Figure 1. <https://blog.globalforestwatch.org/gfw-community/early-warning-systems-for-deforestation-an-explainer>

These questions translate to research needs, and cover needs of country users (both those countries who are developing their own system, and also those are using data from other available EW systems), system developers, the R&D community, and also institutions supporting countries with system development and use, such as the World Bank.

<sup>1</sup> <https://sites.google.com/view/forest-early-warning-portal/home>

<sup>2</sup> [http://www.gofcgold.wur.nl/documents/GFOI\\_RD\\_Priorities\\_2018.pdf](http://www.gofcgold.wur.nl/documents/GFOI_RD_Priorities_2018.pdf)

<sup>3</sup> <http://www.gfoi.org/early-warning-user-needs-assessment-released/>

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The research questions are as follows:

**Forest loss detection: Where (Location of change)?** this question is already well handled by existing systems – however improvements can be made to reduce commission and omission errors in different forest types and ages. **When (Date of change)?** timing and fast delivery of information and alerts is critical for users responding to EW information. Incorporation of radar data is already starting to overcome delays due to cloud cover, and integration of new and upcoming missions (i.e. Sentinels) can further address this problem. Some users (for example prosecutors) require accurate dates of forest loss, so integration of additional data sources (incl. ancillary data from the ground) and understanding time uncertainties and delays in alerting are important to support this.

**Prioritization of data: Whether to respond (Importance of change, and identification of illegal activities)?** Research opportunities are driven by technical developments including spatial analysis and effective use of spatial information (such as data on concessions, and documents on land ownership etc.), which will allow identification of potentially illegal activities, and thus prioritization of alerts for responses. Researchers must work closely with users to understand the types of changes critical for intervention and integrate methods within governance structures and legal frameworks.

**Identification of drivers: Why did the change happen (driver)?** there is a need to move from simple alerting to characterizing the type, drivers, and context of change, which is also relevant for the prioritization of data. Options to better characterize change include high-resolution satellite data (i.e. from Planet or Terra-SAR), machine learning, or use of ground data. Many users requested the separation of anthropogenic from natural changes, whether changes happen in natural forest or plantations, and what the main change activities on the ground are (i.e. logging, clearing, burning). Mobile apps used by forest rangers or community members can be used to facilitate the collection of field data. Integration of local knowledge is also key in this stage.

**Timely communication of results: Who to inform and when?** In some cases, for example, the relevant government entities should be informed before alerts are made public. Developing a system which is flexible and can be useful for a variety of user groups requires good knowledge of the potential use cases.

**Impact to reduce deforestation: How to respond?** the type of actions and responses requires a long-term and efficient dialog between the technical communities understanding also the uncertainties and limitations of alerting systems and non-technical partners. Research will be use-case specific and requires governance and legal experts and stakeholders to be involved in both the scientific work and implementation. Assessing the effectiveness of various interventions would be the final step.

### Guidance materials and capacity building for EW

On a broader level, more comprehensive guidance is needed to support users to make good and appropriate use of existing data. Although some guidance is already available, for example the GLAD Alerts<sup>4</sup> have a frequently asked questions page for users<sup>5</sup> a more generic guidance document, which also allows users to assess which system is most appropriate for their situation and clearly communicates the limitations of such systems would be useful. Training and education are also crucial to encourage uptake of EW systems, and lack of understanding of the data will limit the use of such systems, particularly for non-technical stakeholders. Creating user guidance for specific audiences such as law enforcement officials and local communities in user-friendly formats would help, as would focused trainings based on the guidance materials.

A number of activities have been listed below, and may be considered for action by the GFOI R&D component.

### Priority R&D for EW systems

The following activities, mainly related to the first three steps in the EW system are proposed:

- Develop case studies detailing the successful creation of EW systems at the country level, with the involvement of local government or academic institutions. These case studies can provide lessons learned for countries looking to create their own systems and serve as the basis for south-south exchanges to transfer knowledge between countries.
- Work with space data providers to improve data delivery for EW purposes and explore evolving (future) opportunities to apply satellite missions to EW

<sup>4</sup> GLAD (Global Land Analysis & Discovery) lab at the University of Maryland: <http://data.globalforestwatch.org/datasets/glad-confidence-footprint>

<sup>5</sup> <https://www.globalforestwatch.org/howto>

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- Advocate for open methods and flexibility of systems to incorporate new data for existing and future EW systems, in particular GLAD and JFAST which are currently being used operationally.
- Promote through case study demonstrations, and provide guidance on multi-sensor approaches, including for the integration of new data such as Sentinels in existing EW systems.
- Develop methodological advice on alerting in a range of forest systems (such as in secondary forest, mangroves, savannas and peatlands) determination of drivers of forest change (in particular anthropogenic vs. natural) – using both semi-automated and non-automated methods including machine learning, big data/artificial intelligence, blockchain technology, visual interpretation of satellite imagery, and spatial analysis with other contextual information. This may also include use of information on deforestation speed, size, and pattern which can support prioritization of alerts.
- Develop a work stream on the use of crowd-sourced data, from community groups to validate drivers of change and provide other useful ancillary data used to guide decision making on actions to be taken.
- Develop user-specific guidance materials on the use of existing EW data.
- Assess EW systems and associated tools using the CALM criteria<sup>6</sup> to deliver a coherent message to users about the maturity of various approaches.

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**About GFOI:** The Global Forest Observations Initiative (GFOI) is an informal partnership which coordinates international support to developing countries (countries) on forest monitoring and greenhouse gas (GHG) accounting for REDD+ and related activities.

**About the R&D component:** [The Research and Development Coordination Component of GFOI](#) seeks to ensure that methodological and technical issues hindering action are brought to the attention of the scientific community and prioritized for new research and development.

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<sup>6</sup> CALM: Criteria for consistently assessing levels of maturity: [https://www.reddcompass.org/documents/184/0/GFOI\\_CALM\\_Criteria\\_1.0.pdf/6ba261e1-e169-44f0-9550-3194225bd10d](https://www.reddcompass.org/documents/184/0/GFOI_CALM_Criteria_1.0.pdf/6ba261e1-e169-44f0-9550-3194225bd10d)

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