Comments from Public Consultation on ECV Requirements 13/01 – 13/03 2020 for:

# Above-ground biomass

## ECV Product: Above-ground biomass

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| **Name** | Above-ground biomass | | | | |
| **Definition** | Above-ground biomass is defined as the mass of live and/or dead organic matter in terrestrial vegetation | | | | |
| **Unit** | Mass of dry weight in metric tons | | | | |
| **Note** | Definition can vary for different observations/products in terms including live and/or dead biomass, or for which vegetation compartments (woody, branches, and leaves). There are differences in what different satellite and in-situ observations actually measure. A clear definition needs to be provided with each measurement/product, and consistency is to be ensured, and ECV products might include flexibility in information to respond to different definition requirements (i.e. including different estimates for different compartments). | | | | |
| **Requirements** | | | | | |
| **Item needed** | **Unit** | Metric | **Quality** | Value | **Derivation and References and Standards** |
| **Horizontal Resolution** | M | Pixel-size | G | 10-100 | This resolution reflects the need to have biomass data at the scale of human-induced disturbance. Suitable resolution can vary by ecozone; biomass is a rapidly varying quantity in space and the variance when moving to more detailed spatial resolutions is getting enormous and very hard to be captured efficiently by varying observation sources; especially for natural and tropical forests. Current understanding practices suggest a horizontal resolution of 0.25 ha (50x50 m) outside the (sub-)tropics and a horizontal resolution of 1 ha (100x100 m) in the tropics for global products. In specific regions of interest and areas of active (forest/land) change higher resolution data can be helpful. Higher quality regional biomass maps can be used for the calibration and validation of global products. |
| B | 100-1000 | This resolution is suitable for most regional vegetation and carbon modeling and assessing the impact of climate extremes. Deriving biomass estimates at resolutions coarser than the original one (i.e. from 10-100 m) can reduce uncertainties and provide more robust data; while reducing the spatial detail. |
| T | > 1000 | This resolution is suitable for global vegetation, carbon and climate models. Deriving biomass estimates at resolutions coarser than the original one (i.e. from 10-100 m) can reduce uncertainties and provide more robust data; while reducing the spatial detail. |
| **Vertical Resolution** | N/A | Set to NA since ECV products provide estimates as total over a certain area without further vertical discrimination. There is however evolving products on tree/vegetation height and structure that are very related to biomass and could eventually be considered as a “third” dimension for biomass ECV products. | G |  |  |
| B |  |  |
| T |  |  |
| **Temporal Resolution** | Years | Changes in biomass stocks (t/ha) over time (i.e. per year) are important to assess forest carbon gains and losses | G | Intra-annual | Biomass data more detailed than annual time steps are of value for assessing and modeling the impact of disturbances such as fires and forest degradation, and for seasonal variability in biomass productivity. There is also interest for more near-real time updates and estimates of forest biomass changes for (local) enforcement and accounting applications. |
| B | 1-2 years | Annual and bi-annual time steps are used by many models and carbon accounting applications requiring biomass data. |
| T | 5-10 yearly | One time is the minimum requirement but should be of high quality/low uncertainty. Temporal sampling increases are need to track changes and for long-term biomass trends information every 5-10 years is suitable. |
| **Timeliness** | Years | The speed of delivery of biomass data determines their usefulness for regular reporting, updating and enforcement applications | G | Monthly-annual | Ideally, biomass measurements become available soon after the acquisition of the data for regular updating in regional hotspots, in case of major disturbances and climate extremes etc.. Speed of delivery of biomass information might come at the risk that full quality assurance and independent validation cannot be completed in near-real time as well. |
| B | Annual-5 years | Global biomass measurements become available at least one (to a few) year(s) after the acquisition of the data and quality processing and ECV product derivation and validation, as well as long-term consistency is to be ensured. |
| T | Regular reprocessing of historical records | Model applications require long-term consistent biomass datasets that should take advantage of the whole historical data record. Providing improved and reprocessed historical data records consistent with the recent higher quality ECV estimates should be provided on a regular basis. |
| **Required Measurement Uncertainty** | % (for relative) and tons (for absolute), for different biomass classes/ranges | Relative and absolute bias and confidence interval or RMSE, overall and by biomass class/range derived from using reference data of higher quality | G | 10% | RMSE alone is not a strong indicator of uncertainty as it mixes systematic deviation (also referred to as bias, bias being the term used here) and precision. Bias is often the most significant error and varies among various biomass ranges. Ideally a full error distribution as a function of biomass should be provided but can hardly be achieved in practice. As minimum, a comparison of the ECV product with independent (in-situ) reference data should provide uncertainty related to bias and precision among multiple biomass class/ranges. |
| B | 20% | RMSE alone is not a strong indicator of uncertainty as it mixes systematic deviation (also referred to as bias, bias being the term used here) and precision. Bias is often the most significant error and varies among various biomass ranges. Ideally a full error distribution as a function of biomass should be provided but can hardly be achieved in practice. As minimum, a comparison of the ECV product with independent (in-situ) reference data should provide uncertainty related to bias and precision among multiple biomass class/ranges. |
| T | 30% | RMSE alone is not a strong indicator of uncertainty as it mixes systematic deviation (also referred to as bias, bias being the term used here) and precision. Bias is often the most significant error and varies among various biomass ranges. Ideally a full error distribution as a function of biomass should be provided but can hardly be achieved in practice. As minimum, a comparison of the ECV product with independent (in-situ) reference data should provide uncertainty related to bias and precision among multiple biomass class/ranges. |
| **Stability** | % (for relative) and tons (for absolute), for different biomass classes/ranges | Relative and absolute bias and confidence interval or RMSE, overall and by biomass class/range derived from using multi-date reference data of higher quality | G | 5% | As for uncertainty, stability should be assessed using both relative and absolute bias and RMSE. The stability can be assessed by multi-date independent validation/uncertainty assessments. The stability requirements are tighter that for overall uncertainty since the aim for multi-date ECV data is to provide information on biomass changes. |
| B | 10% | As for uncertainty, stability should be assessed using both relative and absolute bias and RMSE. The stability can be assessed by multi-date independent validation/uncertainty assessments. The stability requirements are tighter that for overall uncertainty since the aim for multi-date ECV data is to provide information on biomass changes. |
| T | 20% | As for uncertainty, stability should be assessed using both relative and absolute bias and RMSE. The stability can be assessed by multi-date independent validation/uncertainty assessments. The stability requirements are tighter that for overall uncertainty since the aim for multi-date ECV data is to provide information on biomass changes. |
| **Standards and References** |  | | | | |
| **Adaptation and Extremes** | | | | | |
|  | Relevant? (Yes/No) | Sugg. Req. sufficient? (Yes/No) | Explanation | | |
| **Adaptation[1]** | Yes | Partly | So far there are few experiences of using biomass data for adaptation although there is a link between forest biomass and the resilience and adaptability of land use practices/decisions and landscapes to changing climate conditions. In any event, high-spatial resolution data and quality data applicable on a local level will be required. | | |
| **Extremes[2]** | Yes | Partly | The impact of climate extreme events such as droughts, fires and heat waves on biomass stocks is an important climate-vegetation feedback mechanism that remains rather poorly understood and quantified. Improved biomass data provided on temporal and spatial scales relevant to track impacts of climate extremes and memory effects in climate-vegetation interactions are desired and most reflected in the “goal” requirements and specifications. | | |

[1] Is the ECV Product directly relevant to support Climate Adaptation?

[2] Can the ECV Product be used to monitor climate extremes or aspects of extremes?

### Comment 1

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| Author: Nic Bax | Email: nic.bax@csiro.au |
| It is unclear what level of discrimination of type of above ground biomass is available. In the marine environment our habitat variables include mangroves, seagrass, macroalgae and coral. Without sufficient resolution the ECV will have no value in adaptation and there will likely be overlap with marine habitat ECV that included above ground biomass. Also no opportunity to use ECVs for climate impacts. | |

### Comment 2

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| Author: Click here to enter text. | Email: debhem@hotmail.co.uk |
| It would be really useful for evaluation of vegetation modelled in Land Surface / Earth System Models if cross-comparison of Above Ground Biomass and Leaf Area Index were available, potentially through monthly AGB estimates. Monthly (or shorter) AGB estimates would also help with long-term assessments of phenology changes. | |

### Comment 3

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| Author: Andy Wilshire | Email: andy.wiltshire953@gmail.com |
| I would highly support the need for the 'Breakthrough' level. The next generation ESMs will aim to tackle forest regrowth, mortality and disturbance. These datasets will be essential to delivering the next generation capability and understanding. | |

### Comment 4

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| Author: ECMWF | Email: ecresgcosreqs@gmail.com |
| Biomass ECV at annual frequency and 1000m (or better) resolution is useful for global modelling verification. Information on height at 100m spatial resolution (or better) is useful for radiative transfer models that aim at representing within canopy processes. Biomass is key for carbon budget and cross-validation of land-use changes for future CO2 monitoring and verification capacity. | |