

**Sub-task Number:** US-09-03d

**Sub-task Title:** Global Phenology Data

**Overarching Task:** Cross-Cutting Products and Services

**Area:** USER ENGAGEMENT

**Relevant Committee:** UIC

**Related Targets:** (to be included in 2009)

**Sub-task Definition** (as given in the 2009-2011 Work Plan):

Coordinate the collection of in-situ phenology observations and expand existing observing networks. Identify and generate satellite-derived phenological/temporal metrics and test models for describing the phenological characteristics of natural and modified ecosystems. Changes in vegetation phenology impact biodiversity, net primary productivity, species distribution, albedo, biomass and ultimately the global climate.

**Leads** (GEO Member or PO, Entity carrying out the work, Contact: e-mail):

Austria, Point of Contact: Elisabeth Koch; ZAMG; Elisabeth.koch@zamg.ac.at

USA (USDA/Forest Service), Danny Lee, dcleee@fs.fed.us

USA (USGS), Jake Weltzin, USA National Phenology Network, jweltzin@usgs.gov

USA (UWM), Mark Schwartz, University of Wisconsin-Milwaukee, mds@uwm.edu

### **Motivation/Background**

During the past decade phenology has rapidly become an important and cost effective tool for climate change impact studies. In the 4th assessment report of IPCC the results of phenological research play a major role in assessing the observed changes in natural and managed systems. The impacts of climate change on plants can be easily observed which is also one of the reasons why phenology has gained a huge public interest and phenological topics are often found in the media.

Potential applications for phenological data include:

- interaction between atmosphere and biosphere is a crucial area of study for increasing knowledge of critical exchanges in the planetary carbon balance
- important and necessary to have ground truth observations for NDVI-data (normalized differential vegetation Index – photosynthetic activity)
- Vegetation influences the albedo, the evapo/transpiration and thus the energy budget of the earth – atmosphere system
- knowledge about and the input of the status of vegetation leads also to a better performance of NWP models
- pollen shedding models

Phenological data are also important to ground truth land surface phenological observations from satellite data (e.g., NDVI, or Normalised Difference Vegetation Index). For example, ground- and satellite-based observations can be coupled with meteorological measurements for crop-yield modelling. Aside from national, or in the case of Europe regional, phenology networks, there are few established, coordinated in-situ data collections to validate this remotely sensed data across large, diverse areas, particularly at higher latitudes where rates of change may be greatest. A global phenology network that is designed, in part, to span the scales of in-situ, site-specific collections to continuous, remote sensing data will contribute greatly to our scientific understanding of phenology and associated terrestrial ecosystem functions.

Vegetation influences the albedo, the evapo/transpiration and thus the energy budget of the earth-atmosphere system. Knowledge about, and the input of the status of vegetation, can also improve performance of NWP models. The interaction between atmosphere and biosphere is a crucial area of study for increasing knowledge of critical exchanges in the planetary carbon balance. The earlier onset of spring and the

emergence of invasive species across much of Europe has created new health issues that can be informed by phenological data (e.g., ragweed has prolonged the pollen season and greatly increased allergy suffering in susceptible European populations).

There are a number of existing phenology networks, principally in North America, Europe and Asia, that focus on observations of in-situ or land surface phenology; however, these networks are not well-coordinated. This task will offer a mechanism to bring a level of standardization to collecting this important ecosystem parameter and also for expanding the networks throughout the world. It will leverage heavily from existing efforts by the Phenology Commission of the International Society for Biometeorology to establish a global phenology monitoring project.

A global phenology network will include data collection by citizen scientists throughout the globe, thus serving an important outreach function for GEO.

**Outputs** (e.g. products and services which result from the activities of the Task/sub-task; outlined in the form of deliverables with timelines)

Planned:

- Open access for research and education to the pan European phenological database built up by COST action 725 > in 2009
- Implementation of pollen shedding models in biometeorological forecasts (COST Action ES0603: Assessment of production, release, distribution and health impact of allergenic pollen in Europe [http://www.cost.esf.org/index.php?id=205&action\\_number=ES0603](http://www.cost.esf.org/index.php?id=205&action_number=ES0603))

Produced (current status):

- Under COST725 a plant phenological database of European networks has been built up, observational phenological guidelines were unified in Europe [www.zamg.ac.at/cost725](http://www.zamg.ac.at/cost725)
- Many scientific publications among them the COST725 box in 4th Assessment Report of Working Group II (chapter 1) of the Intergovernmental Panel on Climate Change IPCC
- “Guidelines for plant phenological observations” published on <http://www.omm.urv.cat/documentation.html>
- USA National Phenology Network has drafted plant monitoring protocols for ~150 species, and is scoping a new animal phenology program
- COST 725 International Conference on Scope and current limits of linking phenology and climatology, Geisenheim Research Centre, Germany, 10. - 12.03.2009 <http://www.campus-geisenheim.de/Cost725.2832.0.html>

**Activities** (operations or work processes through which resources are mobilized to produce specific outputs; outlined in the form of milestones including timelines)

Planned:

- Host a workshop of national phenology efforts and others on the potential benefits of initiating a Global Phenology Network, by 31 December 2009.
- Develop a Concept and Implementation Document describing the Global Phenology Network and its initiation, within 6 months of the completion of the workshop.

- PEP725: pan European phenological Database, a project submitted to EUMETNET council, with the following time table:

Year	Activity
1	Kick off workshop of participants, data collection of data before 1950 and after 2000 from the participating NOPs, developing and implementation of quality control routines, update and maintenance of the database, developing of an attractive web portal (e.g. visualization of data e.g. flashmaps, time series, pheno-maps of mean data...), PR, evaluation of the status and progress
2	data organisation from partners, quality checking of data, update and maintenance of the database and web portal, improving quality control routines PR, evaluation of the status and progress
3	data organisation from partners, quality checking of data, update and maintenance of the database and web portal, improving quality control routines, workshop of participants with evaluation of the status and progress, PR
4	data organisation from partners, quality checking of data, update and maintenance of the database and web portal, improving quality control routines, PR, evaluation of the status and progress
5	data organisation from partners, quality checking of data, update and maintenance of the database, improving quality control routines, workshop of participants (developing of new ideas for the follow up project), PR

The proposed project will provide a high quality data product for wide parts of Europe based on the experience and knowledge of the involved countries / network operators and of the findings of COST725, and an attractive webpage for all nature interested people. To achieve that new data quality checking routines will be introduced. After the Kick off workshop two more workshops will be organized and the findings of PEP725 will be presented at international conferences.

Progress (current status):

- Assembling Task Participants for Global Phenology Network workshop
- Project PEP725 was submitted to EUMETNET council and will be evaluated in March 2009

Resources (indication of resources – e.g. financial, human – contributed by GEO Members or Participating Organizations to produce outputs)

- Ecosystems Classification and Mapping, EC-06-02
- Resources for the Global Phenology Network workshop have yet to be found
- Financial breakdown of PEP725:

year	personal costs, 4 person months for WP database and WP webpage <sup>#</sup>	personal costs covered by ZAMG	travel costs*	technical IR, project management, PR covered by ZAMG	Total	Total requested from EUMETNET
1	€ 18,000.00	€ 9,000.00	€ 6,000.00	€ 2,500.00	€ 35,500.00	€ 15,000.00
2	€ 18,540.00	€ 9,270.00		€ 1,250.00	€ 29,060.00	€ 9,270.00
3	€ 19,096.20	€ 9,548.10	€ 6,360.00	€ 2,652.25	€ 37,656.55	€ 15,908.10
4	€ 19,669.09	€ 9,834.54		€ 1,326.13	€ 30,829.76	€ 9,834.54
5	€ 20,259.16	€ 10,129.58	€ 6,742.00	€ 2,813.77	€ 39,944.51	€ 16,871.58
<b>1-5</b>	<b>€95,564.44</b>	<b>€47,782.22</b>	<b>€19,102.00</b>	<b>€10,542.15</b>	<b>€133,046.31</b>	<b>€66,884.22</b>

\*for participation on workshops for partners from countries in transition

**Architecture and Data Component**

1) Please briefly describe any task-related Earth observation resources (data set, system, website/portal) and any related Web Service interfaces that are contributed to GEOSS. State whether these items are or will be registered with the GEOSS Component and Service Registry for access via the GEO Web Portals, and whether any associated standards or other interoperability arrangements will be registered in the Standards and Interoperability Registry.

2) Please also describe what data and information your activity/system needs that you would request to be accessible through the GEOSS Common Infrastructure.

**Capacity Building Component**

(capacity building is defined to include the development of capacity related to: (i) Infrastructure and technology transfer (Hardware, Software and other technology required to develop, access and use EO); (ii) Individuals (education and training of individuals to be aware of, access, use and develop EO) and (iii) Institutions – building policies, programs & organizational structures to enhance the value of EO data and products).

1) In accordance with the above definition does this Task have a capacity-building component? If so, please provide a short description of this component including a description of end users.

The Global Phenology Network will leverage on existing cyberinfrastructure developed and in use by the European and USA national phenology networks. In turn, the GPN can contribute CI (including hardware but especially software and programming) and other aspects of infrastructure (e.g., monitoring protocols) to developing nations. The GPN will also leverage on existing education/outreach programs developed by the various national networks, and can be used as a clearinghouse or distribution center, and can be used to set international standards, as well as provide examples and templates. In sum, there will be substantial opportunity to develop programs and organizational structures that will benefit the national and international EO.

2) Have any additional CB needs for this Task been identified? Please provide a short description.

None known, although it is likely that resources will be required to support CB in developing nations (e.g., communications, technology transfer, program development).

**User Engagement Component**

(please briefly describe to what extent end users are engaged in this Task and influence the nature of the outputs produced)

**Science and Technology (S&T) Component**

1) Please briefly describe the elements of scientific research or technological development contained in this Task.

2) In relation to the S&T component(s) of this task, please describe gaps, priorities, continuity needs, barriers, scientific expertise and additional resource needs (this information will be used for developing a gaps and needs assessment in Task ST-09-01)

**Members and POs' Contributions to Outputs and Activities above:**

(Input is optional. This section gives the chance to Members and POs to provide more details (3-5 lines) on their individual activities, making a clear connection with the Outputs and Activities outlined above).

To be determined.

**Norway**

Norut-Tromsø is one of the leading institutes in Scandinavia dealing with phenological mapping and monitoring utilizing remote sensing data. Our phenology efforts mainly focus on the study of cyclic events

of nature, in response to seasonal and climatic changes to the environment. The main study area is Northern Scandinavia, Arctic regions and to a smaller extent the entire northern circumpolar regions. In our research activity we perform year-around monitoring verifying snow cover conditions during winter and different phenological events during summer comprising start of the growing season, midsummer, and end of growing season. In our studies we combine remote sensing with phenological observations recorded in the field. The overall objective of our phenology studies are to establish knowledge about ongoing large-scale changes in the phenological cycle and primary production of vegetation on national and regional levels, in order to investigate selected biological, economical, and social consequences of observed and predicted changes.

The contributions from our side to the Global Phenology Data project will be knowledge on phenology events for northern European regions. This will include time series of phenological in-situ data as well as time-series recorded from satellite (GIMMS, Modis, Landsat).

**Participation** (Partial list of participants, to be expanded as the project develops):

Type	Representing	Organisation	Name	EmailAddress
Lead(PoC)	Austria	ZAMG	Elisabeth Koch	Elisabeth.koch@zamg.ac.at
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Lead	USA	USA National Phenology Network	Jake Weltzin	jweltzin@usgs.gov
Lead	USA	USDA/Forest Service	Danny Lee	dclee@fs.fed.us
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