



Questions & Answers Session 2

Please type your questions in the Question Box. We will try our best to get to all your questions. If we don't, feel free to email Amber McCullum (amberjean.mccullum@nasa.gov) or Juan Torres-Pérez (juan.l.torresperez@nasa.gov).

Question 1: Is it possible to observe Phenology without using remote sensing?

Answer 1: Yes, many of the networks we are covering today provide examples of ground-based networks for observing phenology. I would suggest getting started with NPN and Nature's Notebook.

Question 2: How to plot coordination for getting information about certain location?

Answer 2: Depending on the software you are using there will be different methods for plotting site locations. For example, if you are using a GIS (QGIS or ArcGIS) you can make an excel table of the latitude and longitude and use that to generate a point shapefile of those locations.

Question 3: How highly constrained can some of these sensors be at assessing PAR/FPAR during wet or seasons?

Answer 3: FPAR is the fraction of incoming solar energy absorbed through photosynthesis at 400 to 700 nanometers. The MODIS and VIIRS products have been validated with ground-based information. I know that the validation process has been conducted in various ecosystems including grasses, savannah, broadleaf and needle leaf forest. I am not familiar with the extensive validation process for these products, but more information on this can be found here:

- https://viirsland.gsfc.nasa.gov/Val/LAI_Fpar_Val.html

Question 4: I am working on tracking phenological changes on cereals in Europe. If I am working with single bands and indices, is there a way to rescale the values of indices to match the reflectance values of single bands that normally goes from 0 to positive values?

Answer 4: I think I need a bit more information to be able to answer this question. Can you clarify which bands and indices you are using. In session 3 we will provide an example of a comparison of the NDVI and EVI from VIIRS and with two other indices, from PhenoCam



sensors called the Green Chromatic Coordinate GCC and the Vegetation Contrast Index (VCI). The nice thing about the GCC and VCI are that they use only the visible bands (blue, green, red) so you can take a normal image that does not contain the near-infrared band, and still create a ratio that is comparable to the satellite imagery. I am not aware of comparisons with single bands of optical satellite information and ground-based data.

Question 5: What are specific parameters of phenology data required while nature is changing, how does it take the phenology data?

Answer 5: This depends on the system you are interested in. You could compare leaf out of a maple (ground-based) for example to the NDVI to identify the start of spring for example. You could also compare changes in leaf color via ground based information to NDVI declines as indicated at the end of the season. We will discuss how to compare the ground-based data and the remote sensing data in session 3, so stay tuned.

Question 6: Is NPN global?

Answer 6: No, it is just for the United States. As I mentioned, many of the networks we will cover are U.S. based. There are Phenocam data available in other regions of the world, such as Europe. There is also a European Phenology network, which I mentioned in the presentation as well.

Question 7: I just wanted to know if the accumulated heat you showed in your presentation was measured with ground station or using remotely sensed data such as the thermal infrared band of the sensor mounted in the landsat 8 mission?

Answer 7: The Accumulated degree ground days is obtained from multiple climate products including: NOAA's National Centers for Environmental Prediction (NCEP) Real-Time Mesoscale Analysis (RTMA) products, NOAA NCEP Unrestricted Mesoscale Analysis (URMA) products, and NOAA National Weather Service (NWS) National Digital Forecast Database (NDFD), and PRISM. More information on these products can be found here:

<https://pubs.usgs.gov/of/2017/1003/ofr20171003.pdf>

Question 8: Are there spring indices or AGDD global maps?

Answer 8: No, those from the NPN are just for the US.

Question 9: Can you please explain what exactly is phenophase?



Answer 9: Phenophases are shifts in the timing of recurring plant and animal life-cycle stages. These could include leaf budburst, first flower, fruits, or leaf off events. The timing of phenological events such as leaf budburst and first flower can be quite sensitive to environmental conditions. For example, in a particularly warm and dry spring these phenophases might occur weeks earlier than usual, whereas in an exceptionally cool and wet spring they may be delayed by an equal amount of time. As a result, the timing of phenophases tends to vary among years based on patterns of weather, climate, and resource availability.

Question 10: Is there any problem study pertaining to Human Animal Conflict in Forest region?

Answer 10: I am sure there are studies on this, however as this is not my study area, I am not familiar with any off-hand. Do we have any researchers out there who work in this area? If so, can you offer any examples of this type of work.

<https://www.movebank.org/cms/movebank-main>

Movebank tracks animal/human conflicts so this is a dataset people may be interested in.

This is complex, high-risk data due to security and safety issues related in part to the illicit wildlife trade. If you are interested in a particular country or protected area, you can contact me at: stephanie.jowers@coigne.co.uk. There are networks and Conventions that may be a good starting point. This includes protectedplanet.net, MedPAN, RAMPAO (West Africa), CITES, CMS or Bonn Convention (migratory species), RAMSAR (wetlands) to name a few. My company has its own proprietary, in-house risk monitoring system (e.g., 27 wildlife conservancies in Kenya). Wildlife technology is an evolving field that enables us to collect lots of human-wildlife conflict data globally - and happy to discuss hardware/software components, if helpful 1-on-1

Question 11: In the slide you mean that NEON works with USAmerican data compared with that from the rest of America?

Answer 11: Yes, NEON data are available for only the continental US. There is a core network of 20 sites across the U.S. and a total of 81 aquatic and terrestrial field sites in over 20 ecosystems. You can see a figure of those locations on slide 31 of this presentation.



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Question 12: What is the baseline (normal) period for determining the anomalies for NPN spring indices?

Answer 12: The baseline climatology is 1981-2010.

Question 13: Does NEON data portal support to create localized biodiversity hub for small region (say 200 Ha)?

Answer 13: The NEON data are ground-based sensors (towers) that collect localized information. So if the site is located in a region where you are interested in studying, then the NEON data could be used in conjunction with biodiversity research.

Question 14: Do the NEON data portal and the NPN Visualization Tool also have data from outside the USA?

Answer 14: No, both of those data systems are for the U.S. only. We hope that by showing these examples, a model can be put forth for other networks in regions around the globe.

Question 15: In NEON portal, is it available for CO2 flux data as well?

Answer 15: Yes I do think that the NEON towers are collecting CO2 flux data. You can search for the data products for each of the towers at the Explore Data Products site here: <https://data.neonscience.org/data-products/explore>

Question 16: What is the extent (geographic coverage) of NEON's airborne data for each ecological domain?

Answer 16: The aircraft collects gridded lidar data at one meter spatial resolution, and digital photography at .25 m resolution. Each year, NEON surveys 75% of field sites on a rotating basis. The flight box for each field site ranges from 100-300km². More info can be found here: <https://www.neonscience.org/data-collection/airborne-remote-sensing>

Question 17: Is it possible to join the PhenoCam project and include sites from other countries?

Answer 17: Yes, I think you can become part of the PhenoCam network. They are actively seeking new PhenoCam collaborators. Membership in the network is free and completely open. The basic philosophy is as follows: if you contribute camera imagery, we will archive it, process it, and make imagery and data products available to a global community through our project web page. Check out question 3 on the PhenoCam FAQ for more information on how to do this: <https://phenocam.sr.unh.edu/webcam/faq/>



Question 18: In addition to the images on the website <https://www.neonscience.org/data-collection/phenocams>, is there data labeled for individuals in the community?

Answer 18: Can you clarify this question? Not sure what it is asking.

Question 19: Have there been cases where atmospheric conditions may affect the PhenoCam Data on site?

Answer 19: Phenocam recommends removal of data that may be affected by atmospheric conditions such as fog. Here is a R tutorial about working with the data:

<https://www.neonscience.org/phenocam-intro-series>

Question 20: How affected does seed or germplasm production have with respect to the effect of climate change and phenology in each year for Pinus spp species coupled with the seed years of each species? What about Pinus species that have a good production every 5 or 6 years? Can this be noticeable in some way using EVI, NDVI, SAVI, MSAVI or fPAR?

Which of these has the most precision?

Answer 20: I am not familiar with this particular species. But it would depend on the growth of the plant, the “greenness” of the leaves and what the timing is for green up and senescence of the plant, and also the spatial distribution of the species is for the region and how that would compare to the spatial resolution of the RS data. You need to be able to see the shifts over large regions.

Question 21: Would you suggest camera make and specifications for initiating PhenoCam studies?

Answer 21: See Q18. There is documentation on the PhenoCam website about what camera types are recommended

Check out question 3 on the PhenoCam FAQ for more information on how to do this:

<https://phenocam.sr.unh.edu/webcam/faq/>

Question 22: Can we use PhenoCam data in corporate companies for creating a sample case study for users? or this data is only available for academic research?

Answer 22: I believe these data are freely available to anyone. Check the data use policy on the webpage on how to cite the data.

Question 23: Regarding the time series presented on slide 53. Is the ROY a pixel or a region?



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Answer 23: This is an area that contains many pixels of Phenocam.

Question 24: Is there any API to load NEON or other data products?

Answer 24: Here is an R package and training that you can use for the NEON API:

<https://www.neonscience.org/neon-api-usage>

Question 25: For the study of small farms, which platform is best?

Answer 25: It depends on the location. NPN is extensive across the US. ID your area and go online to see if data is available there from these diff regions. Groundbased would be best for smaller regions.

Question 26: Is phenocam data available for Indian regions?

Answer 26: Search using the mapping tool to see if the areas overlap with your region of interest, and if there are no data on indigenous lands in the US, you could suggest the addition of data. However, I would suggest abiding by ethical protocols with the tribal group.

Question 27: Have there been cases where atmospheric conditions may affect the PhenoCam Data on site, such as Smog, Fog, Rain, etc?

Answer 27: See answer to Q__.

Question 28: Does the NPN include data on croplands, grasslands, and rangelands?

Answer 28: Yes. It is very extensive over a wide range of ecosystems. We encourage becoming a member of the NPN network.

Question 29: Does the dacqre only include data from the US?

Answer 29: That is a tool that has the NPN, NEON, and Phenocam networks, which are mostly US. It does include things like the ability to track data available dates for those networks and for some NASA data like VIIRS that is global.

Question 30: When we calculated vegetation indices (e.g. NDVI) using radiance data acquired from the tower-based observation, how could we decide the range of the wavelengths for suitable band? For example, when we want to calculate NDVI, we may need Red band and NIR band. From the tower-based observation, there are so many wavelengths showing spike-like radiance in high resolution data. It's difficult to decide from which



wavelength to which wavelength is suitable for Red band or NIR band. Is there any rules to do that?

Answer 30: We will provide an example where phenocam, data was compared to VIIRS data using the indices mentioned in question 4. Many cameras do not include NIR, so alternative indices exist that only include the visible parts of the spectrum, such as Red, Green, Blue as opposed to red and near-infrared band rations. Stay tuned for more information about this in session 3.

Question 31: Can we register the phenocam images to the ground coordinates so that we can easily correlate with satellite images?

Answer 31: Yes. All the camera data have the lat/long coordinates. Some Phenocam sites have a link to comparisons of the gridded VIIRS data alongside the phenocam, data. When you go to the specific PhenoCam site details you can click on a link that will take you to the LPDACC where you can download the VIIRS data for the specific location where the Phenocam site is located.

Question 32: What is the best scale of phenological product to study invasive species using RS and which aspect of phenology is good in this field?

Answer 32: This really just depends on the particular invasive you are interested in studying. For example, cheatgrass is very extensive in the western US, and therefore due to its spread over large areas and it's unique timing of green-up, NASA RS data can be use to study the spread. For other invasive species that might not cover such a large region or be mixed in with non-invasives over large regions, near-surface or ground-based data may be more appropriate.

Question 33: Does a similar database exist for Europe (Such as NPN and NEON)?

Answer 33: There is a European Phenology Network, but I am not sure how the data are distributed and shared. Here is a paper that outlines that network:

<https://link.springer.com/article/10.1007/s00484-003-0174-2>

Question 34: I use the program Envi and use data from Landsat 5 and 8. If I want to separate healthy vegetation from ill vegetation, what do I have to do?

Answer 34: You could create a threshold value of NDVI that you use to determine if the vegetation is healthy or not. This threshold could be determined be evaluating patterns of NDVI or EVI or time in the ecosystem of interest. Ground-based spectral data would also be



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useful to determine what the threshold value is. We will discuss some threshold values used by the USGS in session 3.

Question 35: Is there any possibility to get hyperspectral dataset from NPN portal??

Answer 35: I believe the NPN is primarily focused on observational ground-based data.

However you can explore the data available here: <https://www.usanpn.org/data>

Question 36: Are those phenocams already in GEE available for research?

Answer 36: I don't think PhenoCam data are available in GEE, as GEE mainly focuses on gridded global data products.

Question 37: we could use this tool to measure greenhouse gas emission (GHE in vegetation?)

Answer 37: NEON data can be used to estimate fluxes in greenhouse gasses. See more information here: <https://www.neonscience.org/data/data-themes/atmosphere>

Question 38: Does NPN also provide LIDAR datasets?

Answer 38: Not that I am aware of. The Airborne flights with NEON do provide lidar data.

More info here: <https://www.neonscience.org/data-collection/airborne-remote-sensing>

Question 39: How easy or difficult is it to access QA/QC issues for the phenology data?

Answer 39: Many of the datasets outlined here have QA/QC flags associated with them, all of NASA data has a layer with the QA flags.

Question 40: Can nature's notebook be used to monitor individual plants?

Answer 40: Yes! You can record information on specific plants and see data for individual species.

Question 41: Is the MODIS based fPAR Computation available for any part of the World?

Answer 41: Yes, all the MODIS data are available globally.

Question 42: What is the appropriate temporal resolution for calculated phenophase?

Answer 42: You can add daily data to Nature's notebook, and they recommend at least weekly data points. A data point where nothing has changed is also valuable to identify these phenophase shifts.