



## Questions & Answers Part 3

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 Britnay Beaudry ([britnay.beaudry@nasa.gov](mailto:britnay.beaudry@nasa.gov)).

### **Question 1: What is the suitable threshold method for dNBR or dNDVI?**

Answer 1: A common threshold reference is proposed by the USGS, and you can see that here: <https://www.usgs.gov/publications/fire-intensity-fire-severity-and-burn-severity-brief-review-and-suggested-usage>

In the case of altering your threshold values, this really relies on analyst interpretation. These categories can be modified based on your understanding of the particular ecosystem of interest, and most importantly ground-based information such as the Composite Burn Index (CBI). Here is a paper with more information on this topic: <https://fireecology.springeropen.com/articles/10.4996/fireecology.0301003>

You can also access information and data for US fires and mapping methods at the Monitoring Trends in Burn Severity (MTBS) interagency program [Mapping Methods | MTBS](#).

I also suggest the ARSET training “Using Earth Observations for Pre- and Post-Fire Monitoring” which covers NBR and dNBR in more depth, as well as a GEE-based demo: <https://appliedsciences.nasa.gov/get-involved/training/english/arset-using-earth-observations-pre-and-post-fire-monitoring>

### **Question 2: Is the Mann-Kendall process possible in Google Earth Engine, or the trend analyzing process like Sen's Slope possible with the NDVI using GEE?**

Answer 2: It looks like both Mann-Kendall and Sen's Slope processes are available within GEE. You can read about how to use them in GEE's “Non-Parametric Trend Analysis” training here: [https://developers.google.com/earth-engine/tutorials/community/nonparametric-trends#mann-kendall\\_trend\\_test](https://developers.google.com/earth-engine/tutorials/community/nonparametric-trends#mann-kendall_trend_test)

### **Question 3: How can we assume a trend in NDVI?**



Answer 3: We can observe trends through time series modeling, which you can read about in GEE here: <https://developers.google.com/earth-engine/tutorials/community/time-series-modeling>

In Part 1 of this series we cover this.

**Question 4: Can you say something about different approaches to aggregating pixel-level indices at higher levels beyond summary statistics at a regional level? For example, are some indices more/less noisy or easier/harder to aggregate? Do patterns of variance imply different habitat types? Things of this nature.**

Answer 4: How indices work in different regions will depend upon which index or region. Some ARSET trainings go further into this and we can provide some examples.

- [Monitoring Aquatic Vegetation with Remote Sensing](#)
- [Crop Mapping using Synthetic Aperture Radar \(SAR\) and Optical Remote Sensing](#)
- [Use of Solar Induced Fluorescence and LIDAR to Assess Vegetation Change and Vulnerability](#)
- [Using Earth Observations for Pre- and Post-Fire Monitoring](#)

**Question 5: What is the best product for monitoring the health of vegetation, and can the products distinguish tree species accurately?**

Answer 5: The “best” products vary based on your region of interest and the type of vegetation you’re working with, as well as things like spatial and temporal resolution. But in terms of products to identify specific species, I would recommend something like the NLCD or another land cover dataset (but this will be at a 30 m resolution). In terms of using indices for species ID, they can assist in something like distinguishing coniferous vs. deciduous, given seasonality. However, hyperspectral data will be needed to differentiate any further. You also have to think about the density of the species that you’re identifying and the spatial resolution of your sensor.

**Question 6: Can the products distinguish crop species?**

Answer 6: See question 5.

**Question 7: Is cloud masking necessary if you have selected images with cloud cover of less than 1%?**



Answer 7: No, you don't have to mask out clouds if you have clear imagery. I almost always perform a cloud mask since I feel I can miss clouds or cloud shadows, but I suppose it is not necessary as long as you note this in your research.

**Question 8: Is the greenest value or index the same as the NDVI?**

Answer 8: I believe you're asking about NDVI versus GNDVI (Green Normalized Difference Vegetation Index). You can read about GNDVI here: <https://pro.arcgis.com/en/pro-app/latest/arcpy/image-analyst/gnvd.htm>.

But their calculations are slightly different, as NDVI uses the NIR and Red bands while GNDVI uses the NIR and Green bands and focuses more on chlorophyll. Best uses can be seen in this resource as well.

**Question 9: Which index has higher accuracy for detecting irrigation areas?**

Answer 9: There are many indices and methods for monitoring agriculture and irrigation. Here are a few ARSET trainings that may be helpful:

- [Satellite Remote Sensing for Agricultural Applications](#)
- [Groundwater Monitoring using Observations from NASA's Gravity Recovery and Climate Experiment \(GRACE\) Missions](#)
- [Applications of Remote Sensing-Based Evapotranspiration Data Products for Agricultural and Water Resource Management](#)

Another source, not necessarily related to spectral indices but very useful, is the OpenET website ([OpenET – Filling the Biggest Gap in Water Data \[openetdata.org\]](#)).

**Question 10: Is there a good centralized reference to find constants for the indices for other regions (e.g., where to find EVI values for G, C1, C2, and L for regions outside of Amazon)? Or does this require searching scientific literature?**

Answer 10: You can read about the history and calculation of the EVI coefficients here: <https://www.sciencedirect.com/science/article/pii/S0034425702000962#BIB17>

**Question 11: Can you say something about how to predict deforestation and monitor its trend using the GEE with help of either the dynamic world dataset or the Hansen Forest Change dataset?**

Answer 11: Google Earth Engine provides training on using Dynamic World and the Hansen Forest Change dataset for forest cover and loss estimation here:



<https://developers.google.com/earth-engine/tutorials/community/forest-cover-loss-estimation>

<https://developers.google.com/earth-engine/tutorials/community/introduction-to-dynamic-world-pt-1>

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### **Question 1: Which image is best for forest fire monitoring?**

Answer 1: The best imagery for your area of interest depends on what is available for that area and time period. You can also consider things like cloud-free imagery, spatial resolution, and temporal resolution. You can learn more available datasets for forest fire monitoring from these ARSET webinars:

- [Using Earth Observations for Pre- and Post-Fire Monitoring](#)
- [Satellite Observations and Tools for Fire Risk, Detection, and Analysis](#)

### **Question 2: Is SAVI useful for agricultural applications, specifically at the tail ends of the growing season (planting and harvest) when there is less vegetation on the field?**

Answer 2: The effectiveness of SAVI depends on the resolution of the sensor you're using and the density of the vegetation on the field. For example, if you're calculating SAVI with Landsat data with a spatial resolution of 30 meters, any variety within the vegetation at a resolution less than 30 meters will not be observable.

### **Question 3: Could the SAVI index be useful for monitoring soil aridity conditions?**

Answer 3: SAVI is used to correct Normalized Difference Vegetation Index (NDVI) for the influence of soil brightness in areas where vegetative cover is low. There may be another index better suited for soil aridity, but I will have to look into it.

### **Question 4: Does that mean the products are Landsat and Sentinel-9 and ICESat-2? HLS?**



Answer 4: I'm having a hard time understanding this question, but I believe you're asking about slide 26. This slide just listed identified needs and new data products from the Satellite Needs Working Group (SNWG).

**Question 5: What are the spectral similarities between Landsat 8, Landsat 9, and Sentinel-2?**

Answer 5: In the first session, slides 32 and 33 review the various bands and wavelengths available on Landsat 7-9 and Sentinel-2. The bands that you would use to calculate indices depend on the appropriate wavelength available within each band.

**Question 6: In urban climate studies, the location of trees (especially tree canopy diameter) is useful to calculate sky view factor (SVF). If I'd like to identify trees located on the streets to generate the SVF, could I use NDVI (or another index) to do this? Or do you suggest any other method?**

Answer 6: NDVI to identify trees in an urban area is possible, but not sure if you can isolate specific trees, etc. A higher spatial resolution is needed.

**Question 7: What band combinations are being used for the NDMI and NDWI products you mentioned on the SNWG slide? I often see those terms used interchangeably.**

Answer 7: I believe you're referring to slide 27, which shows the HLS Indices products that will be available from the SNWG. NDMI is the Normalized Difference Moisture Index and NDWI is the Normalized Difference Water Index. The bands used depend on the sensor you're using, but you can read about the uses of NDMI vs. NDWI and the bands used for different sensors at these links below:

- <https://www.usgs.gov/landsat-missions/normalized-difference-moisture-index>
- <https://www.usgs.gov/centers/eros/science/usgs-eros-archive-vegetation-monitoring-eviirs-global-ndwi>
- <https://custom-scripts.sentinel-hub.com/custom-scripts/sentinel-2/ndmi/>
- <https://custom-scripts.sentinel-hub.com/custom-scripts/sentinel-2/ndwi/>

**Question 8: In your opinion, what are the indexes that can be used to identify the crop type?**

Answer 8: In terms of using indices for species identification, indices can realistically only assist in something like distinguishing coniferous vs. deciduous, given seasonality. However, hyperspectral data could be used to differentiate any further. You also have to think about the density of the species that you're identifying and the spatial resolution of your sensor.



**Question 9: Are the Sentinel images included in the HLS dataset resampled to 30m to match Landsat, or are the Sentinel dates still 10m resolution?**

Answer 9: The spatial resolution of HLSS30 and HLSL30 are both 30 meters. You can read about both products here:

<https://lpdaac.usgs.gov/products/hlss30v002/>

<https://lpdaac.usgs.gov/products/hlsl30v002/>

**Question 10: Can we create our own index vector from scratch? In other words, create a bunch of indices that have the ability to track a phenomenon in land cover or land use?**

Answer 10: New indices are being created all the time! It is an exciting field of research.

**Question 11: In Google Earth Engine, what is the function to change the area we need to examine or target?**

Answer 11: You can read how to change your geometry in GEE here:

<https://developers.google.com/earth-engine/guides/geometries>

We use the function Map.centerObject to zoom to a specific object. You can read how to use that function here: <https://developers.google.com/earth-engine/apidocs/map-centerobject>

**Question 12: How can we export objects with generated BRI over our research area to a GeoTiff or ASII file?**

Answer 12: You can learn how to export items from GEE into GeoTIFF format here:

[https://developers.google.com/earth-engine/guides/exporting\\_images](https://developers.google.com/earth-engine/guides/exporting_images)

**Question 13: For the SAVI, the L factor can be changed or defined by us? And if this is the case, what does this change depend on?**

Answer 13: L is a correction factor which ranges from 0 for very high vegetation cover to 1 for very low vegetation cover. The most typically used value is 0.5 which is for intermediate vegetation cover. You can read about how SAVI was created and the correction factor here:

<https://www.sciencedirect.com/science/article/abs/pii/003442578890106X>

**Question 14: What is the relation between NDVI and NBR?**

Answer 14: NBR uses NIR and SWIR bands to identify burned areas. NDVI uses NIR and Red to quantify vegetation greenness.



**Question 15: How can we import a .shp file specifying our area of interest on which we want to calculate the chosen index?**

Answer 15: You can learn how to upload a shapefile to GEE here:

[https://developers.google.com/earth-engine/guides/table\\_upload#upload-a-shapefile](https://developers.google.com/earth-engine/guides/table_upload#upload-a-shapefile)

**Question 16: Could you please explain how you arrive at the atmospheric correction value L in SAVI and the variables G, C1, C2, and L in EVI?**

Answer 16: You can read about how SAVI was created and the correction factor here:

<https://www.sciencedirect.com/science/article/abs/pii/S003442578890106X>

You can read about the history and calculation of the EVI coefficients here:

<https://www.sciencedirect.com/science/article/pii/S0034425702000962#BIB17>

**Question 17: In case of mountain areas, should I adjust any additional preliminary operations in GEE code like topographic correction and something the same?**

Answer 17: You're welcome to add additional preprocessing to your data if it improves your ability to analyze your area of interest! This is an active area of research and I encourage you to explore. An example of a recent article exploring topographic corrections in a forested area can be found here: [Integrated topographic corrections improve forest mapping using Landsat imagery - ScienceDirect](#)

**Question 18: Could you please explain how the equations for the three indexes presented today are arrived at? What is the logic behind subtracting the bands in the numerator and adding them in the denominator?**

Answer 18: The first session of this series focuses on the electromagnetic spectrum and uses NDVI as an example of what an indices is and why we use them in remote sensing, I recommend you review slides 34-36 in the session 1 slides to see how NDVI is calculated. In the code demonstration, we use `.normalizedDifference` to perform that calculation, which is explained here: <https://developers.google.com/earth-engine/apidocs/ee-image-normalizeddifference>

**Question 19: Could you comment on NDVI and potential to investigate seasonal drying and dormancy of vegetation?**



Answer 19: NDVI can be monitored over time to study changes in vegetation trends and seasonality. If you're interested in using NDVI for a time series analysis, I recommend the following trainings:

- <https://appliedsciences.nasa.gov/get-involved/training/english/arset-understanding-phenology-remote-sensing>
- <https://developers.google.com/earth-engine/tutorials/community/time-series-modeling>

**Question 20: Under what conditions would I use NDVI over EVI given that EVI is more sensitive?**

Answer 20: EVI was developed to analyze areas with very dense vegetation or canopy cover, such as the Amazon rainforest. You can read about EVI and its uses here:

<https://www.sciencedirect.com/science/article/pii/S0034425702000962#BIB17>

**Question 21: Since each band has values for a range of wavelengths, could you please explain which wavelength values are used for NIR and for Red? Or for blue or SWIR?**

Answer 21: Which wavelengths are used for an index is specific to the index being calculated. For any index you're interested in using, I recommend reading the scientific literature/articles available, especially for the satellite and sensor you plan to use for your calculation. Review slides 32 and 33 from part one which includes tables with band wavelengths.

**Question 22: What's the minimum size of fire that can be detected with Sentinel-2?**

Answer 22: This depends on Sentinel-2's spatial resolution, which is 10 to 20 meters.