



Questions & Answers Part 1

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: Which parameters should be used in assessing the Economic Ecosystem Service Valuation of a freshwater wetland?

Answer 1: The variables you use will depend on your local study area and desired outcomes. Some that may be of interest are wetland extent and change, which can be assessed by creating something like a land cover map, which we will discuss later in this session and in future sessions. Wetlands can also aid in protection from floods and provide filtering mechanisms for improving water quality. For example, you could assess the potential economic losses to infrastructure (like homes, businesses, roads, etc.) if the wetlands were not present. In session 3 we will give some examples on the valuation of coral reefs in flood and tropical storm damage protection, and something similar could be applied to wetlands. Similarly, you could evaluate the cost of building a water treatment facility to conduct the same level of water filtration that the wetlands may provide.

The International Journal of Biodiversity Science, Ecosystem Services and Management dedicated a volume to Ecosystem Services of Wetlands in 2015. Here's the link to those interested: <https://www.tandfonline.com/toc/tbsm21/11/1>

Question 2: Does SEEA offer any free materials/tools for natural capital accounting?

Answer 2: Yes! UN SEEA has a lot of resources, including trainings, data, and methodologies for NCA. Here is the website: <https://seea.un.org/>. In session 2, we will also review the ARIES platform, which is an integrated, open-source modeling platform for environmental sustainability, where researchers from across the globe can add their own data and models to web-based repositories and the InVest, from the Natural Capital Project.

Question 3: Do you have examples of these ecosystem service valuations that use valuation methods other than dollars?



Answer 3: Yes, we will provide many examples throughout this course, so stay tuned. While many of these focus on economic valuation, other metrics include things like biodiversity, habitat, aesthetic value, positive impact on environmental and mental health.

Question 4: Does the SEEA EA framework take into account demand for ecosystem services, or only supply? Can SEEA be contacted to get help on assessing the economic accounting of a large protected area?

Answer 4: Within the SEEA framework you can evaluate demand, however the EA framework really focuses on the contributions of ecosystems to economic activity, and this is most directly linked to the satellite data and evaluation of the health or degradation of ecosystems. So the physical supply or stock is central to the EA framework.

SEEA has a website for FAQ, and there is a contact link provided on website as well: <https://seea.un.org/content/frequently-asked-questions>

Question 5: What data quality standards have been developed internationally so that users can assess the uncertainty of the data products for application to their particular use.

Answer 5: Within SEEA there are a set of internationally agreed standard concepts, definitions, classifications, accounting rules and tables for producing internationally comparable statistics and accounts. You can get much more detailed information on these set of standards in the documents on the central framework, the Ecosystem accounts, and applications here: <https://seea.un.org/content/methodology>. In the next session we will also discuss the ARIES platform which works towards interoperability of data and methods.

Question 6: Is there any plan in the future that Group on Earth of Observations (GEO) is expanding their program to South East Asia? And are ForestGEO and MarineGEO part of this network?

Answer 6: GEO is a global network, with multiple countries in South East Asia participating in these efforts, you can see the country network map (100+) here: <https://earthobservations.org/members.php>. Yes, I believe ForestGEO and MarineGEO are also part of these efforts. You can see the flagship efforts in the GEO work programme here: https://earthobservations.org/geoss_wp.php



Question 7: What are the standard indicators/variables to assess the impact of climate change on different ecosystems (specifically, mountain and estuarine) and how are they related to human/local wellbeing?

Answer 7: The variables you can use to assess the impact of climate change could be things like change in precipitation and temperature. You could also evaluate desertification, changes in canopy structure, woody biomass, changes to watershed health like water quality, etc. In session 3 we will also give an example of urban heat islands and impacts to human health, and the value of urban trees for mitigating these effects.

Question 8: I heard that economic value is based on scarcity, but here I see that valuation is actually what is there. So which value should I take into account? The actual ES or the values based on economic sense?

Answer 8: I think the key here is the ability to link the ecosystems to the economics, and this will be different depending on the region, and how particular things are valued in the local, regional, and global systems. You can use a market based approach, where the value of a good, such as a food source, can be tracked in the economy. In this sense, scarcity may play a role in how that specific item is valued in the economic supply chain. Stay tuned for more specific examples throughout this series.

Question 9: Are these satellites available and functional in any/every region or country?

Answer 9: Many of the satellites/sensors mentioned here (Landsat series, MODIS, VIIRS, etc.) have world-wide coverage. The temporal resolution will vary depending on the satellite from days to weeks. Some sensors mounted on the International Space Station will have limited coverage.

Question 10: I'd like to ask what is the ENCA approach?

Answer 10: The ENCA or Enabling a Natural Capital Approach uses similar methodologies we have outlined here. It is guidance for policy and decision makers to help them consider the value of a natural capital approach:

<https://www.gov.uk/guidance/enabling-a-natural-capital-approach-enca>

Question 11: Hello, in your opinion what is the most powerful satellite for identifying dense vegetation and detecting land surface temperature anomalies for the present day?

Answer 11: It depends on a variety of things, NDVI and EVI (which is better for dense regions). Both can be calculated using MODIS, VIIRS, or Landsat. For canopy



structure, woody biomass, Lidar or SAR data may be more useful. Temperature, the temporal factor, MODIS or VIIRS can be used on a daily basis. Heat over urban areas you could use landsat if you don't need daily revisit times (every 8 days). There will be trade offs between spatial and temporal resolutions.

Question 12: Is there a tool for the oceans or marine systems?

Answer 12: There is much more data scarcity for the oceans and marine ecosystems than land-based ones. The same applies to valuation of marine ecosystems and most times this is either region-specific or for a particular country or zone within that country. In Session 3 we will mention a couple of reports from the USGS on valuing coral reef ecosystem services in regards to coastal risk reduction in some US jurisdictions (Hawai'i, Puerto Rico, Florida). Here's another study from Townsend et al (2018) that talks about the challenge of assessing marine ecosystem services:

<https://www.frontiersin.org/articles/10.3389/fmars.2018.00359/full>

Another good source of information is the MarineGEO portal: <https://marinegeo.si.edu/>

Question 13: How can hyperspectral data be useful for ecosystem services assessment? Are there any better methods than hyperspectral imaging to estimate the biodiversity assessment over a particular ecosystem?

Answer 13: Hyperspectral data are useful for things like identifying different vegetation species in a particular region. Hyperspectral data have also been used for things like mangrove mapping, which provide many important ecosystem services. Hyperspectral data can also be used for coral reef mapping, etc. Here is a species issue on the use of hyperspectral data for biodiversity:

https://www.mdpi.com/journal/remotesensing/special_issues/hyperspectral_rs_biodiversity

We also have a previous training on an introduction to hyperspectral data:

<https://appliedsciences.nasa.gov/join-mission/training/english/aset-hyperspectral-data-land-and-coastal-systems>

Question 14: Is it correct to say "accounting also means determining values?"

Answer 14: Yes, while mapping ecosystem extent and change is an important piece of the process, determining the value of those resources are really at the heart of ecosystem accounting.



Question 15: For someone assessing ecosystem services of mangrove ecosystems, what remote sensing-based indices could they calculate besides NDVI?

Answer 15: Leaf area index or LAI and the Enhanced Vegetation Index (EVI) could be used. Other less commonly used indices could be useful, such as Green Atmospherically Resistant Vegetation Index (GARI), Wide Dynamic Range Vegetation Index (WDRVI), Green Chlorophyll Index, Red-edge Chlorophyll Index. Here is a paper about that:

https://www.researchgate.net/publication/271037387_Comparison_of_vegetation_indices_for_mangrove_mapping_using_THEOS_data

We also have a previous training on mangrove mapping:

<https://appliedsciences.nasa.gov/join-mission/training/english/arset-remote-sensing-mangroves-support-un-sustainable-development>

Question 16: Is 30m the highest resolution available between all the data sets?

Answer 16: It depends on what data you are using, but given that Landsat is the most commonly used satellite for land cover mapping, and has a resolution of 30 meters, that is often the case. Sentinel-2 has a slightly higher spatial resolution.

Question 17: Do we have access to the resources (learning materials, developed model etc) of SEEA?

Answer 17: Yes, the training materials for SEEA can be found here:

<https://seea.un.org/content/seea-e-learning-resources>

Question 18: For small island environments, what is the best satellite and product to use for mapping coastal vegetation?

Answer 18: The highest spatial resolution that satellite-based NASA data can provide is with Landsat at 30meters. Sentinel-2, provided by ESA, has a bit higher spatial resolution. There are also commercial satellites like WorldView-2, that have higher spatial resolution, but come at a cost. Drones are also often used in smaller regions where higher spatial resolution is needed.

Question 19: How do we estimate forest aboveground biomass of a mixed broad and needle leaf deciduous and evergreen forest?

Answer 19: The most commonly used method is through empirical models that use predictor variables, such as ground-based estimates of Above Ground Biomass (AGB) to NDVI values. This requires local forest inventory data in a region. These types of



studies have used data from Landsat for making these comparisons. Airborne optical and LiDAR data have also been used, but the data are less widely available. Here is a paper that explains an empirical approach using Landsat:

<https://www.sciencedirect.com/science/article/pii/S0924271614002202>

Question 20: To calculate NPP, you mentioned parameters such as FAR, LAI, and land use/land cover. Is that all or there are other factors to be considered?

Answer 20: Here are a few websites that highlight the NASA-provided NPP and GPP products, where you can get more specific information in the metadata for how these are calculated: <https://modis.gsfc.nasa.gov/data/dataproduct/mod17.php>
https://neo.gsfc.nasa.gov/view.php?datasetId=MOD17A2_M_PSN

Question 21: What other variables can we use instead of chlorophyll to reflect/measure primary productivity in seawater? Possibly a variable known or presumed to affect fish movement, or in other words, the choice of foraging areas by seabirds.

Answer 21: You could also evaluate variables like temperature as that might relate to species thresholds in regards to the vegetation. We also had a recent ARSET training devoted to the use of remote sensing for aquatic vegetation that you may find helpful: <https://appliedsciences.nasa.gov/join-mission/training/english/arset-monitoring-aquatic-vegetation-remote-sensing>

Question 22: Are there any hyperspectral satellites that have a high spectral resolution with a high density of bands? These could be transformed to hyperspectral data cubes for e.g. species classification.

Data Cube = Time-series multi-dimensional (space, time, data type) stack of spatially aligned pixels used for efficient and effective data access and analysis.

Answer 22: The simple answer is not currently, most of the hyperspectral data we have available are from airborne sensors. However, there are some upcoming missions, mainly PACE and SBG that will be providing hyperspectral satellite data.

We also have a previous ARSET training on hyperspectral data that you may find useful:

<https://appliedsciences.nasa.gov/join-mission/training/english/arset-hyperspectral-data-land-and-coastal-systems>

Question 23: Could you please elaborate on the difference between ecosystem service valuation and natural capital accounting?



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Answer 23: Natural capital accounting is a form of ecosystem service evaluation. Natural capital accounting (NCA) is an umbrella term covering efforts to use an accounting framework to provide a systematic way to measure and report on stocks and flows of natural capital.

Question 24: How can I differentiate the soil ecosystem service from soil functions?

Answer 24: Many soil functions can be considered ecosystem services, including things like: food, energy provision, water storage and purification, neutralization, filtering and buffering of pollutants, natural hazard regulation, climate regulation, and archiving natural and cultural phenomena. I think the key here is how the function is valued, and for what purpose. If a soil function does not contribute to a human benefit or there is not a perceived value to humans then it can be left out of the service designation.