Questions & Answers Part 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-Peréz (juan.l.torresperez@nasa.gov).

Question 1: Can eDNA be used to identify plant species in aquatic environments?
Answer 1: It is a bit more difficult to do this for plant species, as unlike animal DNA, there are few universal plant DNA markers that can be applied across a wide number of plant species and still effectively identify samples to the species level. But there are researchers working on this. Here is an article about a research team from Canada who are working to use eDNA to survey for aquatic plants: https://psmag.com/environment/identifying-plants-through-their-dna

- Here is the reference for the peer-reviewed article: Kuzmina, M. L., Braukmann, T. W., & Zakharov, E. V. (2018). Finding the pond through the weeds: eDNA reveals underestimated diversity of pondweeds. Applications in Plant Sciences, 6(5), e01155.
- As we discussed last week, there are other variables, like chlorophyll- a, that can be used to identify the presence of things like harmful algal blooms. For example, in the case of cyanobacterial blooms, phycocyanin is a specific pigment associated with these and can be used as an indicator of their presence in water systems. Please refer to the references from last week for more information.

Question 2: I may have missed this information but what do the dots represent?
Answer 2: The dot represents the region (watershed) we are using for obtaining the freeze/thaw data from the webtool (the first example shown). This is where I clicked on the map.

Question 3: Can you download more than one pixel?
Answer 3: As far as I know, you can only download data from one watershed at a time for the freeze/thaw tool and the Climate Extraction tool. For the CCVA tool, you can add your own points (and have multiple points used), and/or use the template and example data used from the RAP team.

Question 4: I'm not aware of anything like this for Africa?
Answer 4: No I am not aware of similar tools for Africa, but if any of our participants are aware of any other such tools, please feel free to include a link in the Q&A. Here is another reference provided from a webinar participant for a similar tool in the Pacific Northwest region: http://www.psmfc.org/program/streamnet

- Here is another example from the Chesapeake region that a participant provided: The Freshwater Network Chesapeake Fish Passage Prioritization project tool https://maps.freshwaternetwork.org/chesapeake/
- Additionally, here's a recent review particularly on water quality for freshwater ecosystems analysis that includes some information from African systems: https://www.mdpi.com/2076-3263/8/2/45

Question 5: Explore Salmon habitat tool is not working today :(
Answer 5: Yes, it seems like the RAP tools are experiencing too much user traffic. So if you are interested, please come back to these examples at a later date.

Question 6: Do these metrics and climate change vulnerability assessment database will be for over the world? Example for East Africa and Asia?
Answer 6: No, for this tool it is just for the Pacific Northwest and Pacific Rim region. If there are any other examples that the participants are aware of please provide them in the Q&A.

Question 7: What is the benefit of using the RAP tool instead of a GIS?
Answer 7: The benefit is that you can run these analyses and generate graphs and conduct climate change vulnerability assessments within the tool. You don't have to download the data. It's entirely possible to do this in a GIS, you'd just have to do a lot of these same steps. Sometimes it can be clunkier to do it that way. It really is preference. If you are downloading your own data, such as Landsat, to create a land cover map this takes more time, but you know each and every step in the process, so you understand the data well. So that's the benefit of using GIS and going through your own processes. But the benefit of tools like RAP is the online component - the ability to run these analyses without having to go through a lot of complicated steps that can take a lot of time and use a lot of space on your computer.

Question 8: Can the RAP tool be used to identify species in a watershed?

Answer 8: Not that I'm aware of. The RAP tool can ingest your own data about species in the region if you're interested in conducting something like the climate change vulnerability assessment. But I don't believe they have a library of DNA markers or species markers for this region within the tool itself. I would refer to the website for clarification, but I don't believe the tool is designed to identify many species in the region. I believe it's meant to focus on salmonids.

Question 9: Can we develop a global tool such as RAP?
Answer 9: I believe that - it would take a lot of time. But it's certainly possible. This provides an example of what can be done for a specific region. But it outlines the data needs and additional region-specific information. Creating a global tool would take a lot of effort, require input from scientists around the globe.

Question 10: Is this type of analysis and data (e.g resistance mapping) often combined with habitat simulation?
Answer 10: Yes, we provide a couple of examples. But these types of maps can be very useful for things like connectivity modeling. Here is a great list of some connectivity models: http://corridordesign.org/designing_corridors/resources/gis_tools

Question 11: What are the differences/impacts when applying these 5 methods in freshwater and marine ecosystem?
Answer 11: I am assuming this question refers to the statistical methods for finding the best fitting resistance layers. These are: Regression analysis, Spatial autocorrelation, Bayesian clustering, Multivariate analyses, Mantel's test. The best test (and therefore resistance map layer or model to choose) will be really dependent on your region and how well the map layer represents gene flow based on your in-situ data and other factors. You will likely need to use multiple tests and run your connectivity models many times to find the best fit. Many studies use a combination of tests.

Please refer to this reference for more information on each test. A great resources with pros and cons for each. Manuel et al. 2003:
https://www.sciencedirect.com/science/article/abs/pii/S0169534703000089

Question 12: What is the main factor in a CCVA to come up different color in a spatial analysis?
Answer 12: Greener colors indicated healthier and warmer colors were more vulnerable. Anthropogenic land cover influences were big factors. A system that is already vulnerable will be at a higher risk due to slight changes in temperature, runoff, or stream flow.

Question 13: Is this type of analysis and data (e.g resistance mapping) often combined with habitat simulation?
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References:

- Manuel et al. 2003: https://www.sciencedirect.com/science/article/abs/pii/S0169534703000089
- Jaisuk and Senanan 2018: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5845392/
- Brook Charr example: https://www.canadiangeographic.ca/article/la-mauricie-national-park-paddles-and-pines
- Florida Python example: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0121655
- A presentation about a few NASA MBON projects: https://cce.nasa.gov/biodiversity/pdf/meetings/mbon2018/0900_Muller-Karger_Sanctuaries_MBON_FMK_Short.pdf
- Hand et al 2015: https://onlinelibrary.wiley.com/doi/full/10.1111/mec.13517
- A few references for freeze/thaw from brightness temperature:
    - https://www.sciencedirect.com/science/article/pii/S0034425717300172
    - https://www.sciencedirect.com/science/article/pii/S003442570900248X
- StreamNet (a reference provided from a participant), that is a tool similar to RAP:
    - http://www.psmfc.org/program/streamnet