DEEPER DIVE: MULTI-CRITERIA EVALUATION & ANALYTICAL HIERARCHY PROCESS

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OUTLINE

- Multi-criteria Evaluation (MCE)
    - Background
    - Technical considerations
    - Application
- Analytical Hierarchy Process (AHP)
    - Background
    - Technical considerations
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- Conclusions and next steps

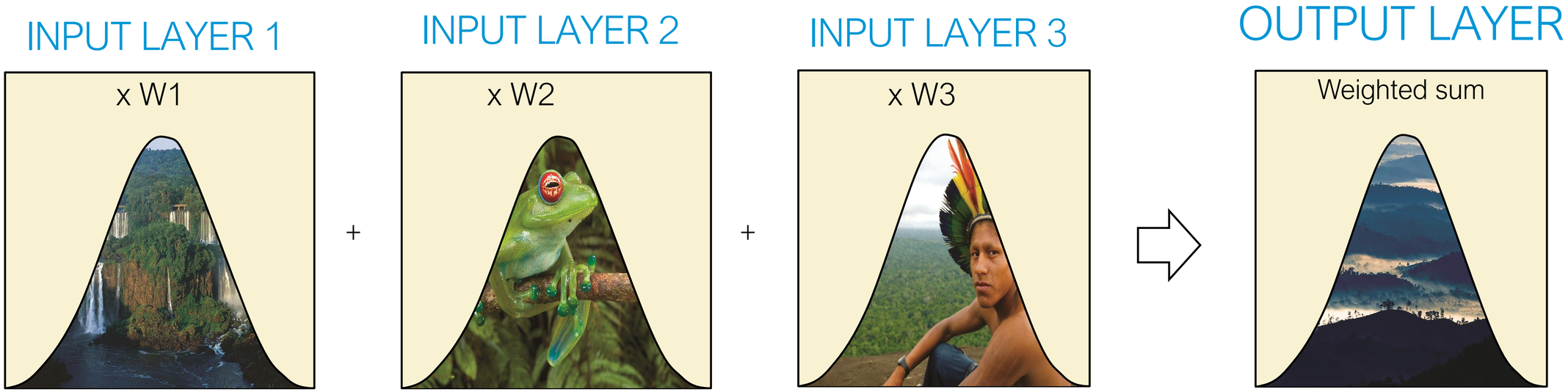
MULTI-CRITERIA EVALUATION

Bringing the data together

BACKGROUND

- Multi-criteria analysis (MCA) is also known as Multi-Criteria Decision making or Multi-Criteria Evaluation is one method that can be used to combine many factors, such as ecosystem service benefits, to one summary output

- Weighted sum is a common method for performing MCA in a GIS to combine input layers and create a composite output layer



TECHNICAL CONSIDERATIONS - INPUTS

Preprocessing of input layers:

- All input data needs to be at least ordinal (categorical or Boolean variables can be included if they can be converted)
- Input layers should be in raster format and the same resolution
- Input layers rescaled to common range (such as from 0 – 1)
- The methods used to rescale the data can have a large impact on the resulting output – often best to try an minimize distortion

TECHNICAL CONSIDERATIONS - WEIGHTS

Assigning weights to the input layers:

- Testing multiple weights and combinations can provide insights into the model/assumptions

- When assigning weights it can be helpful to understand the distribution of the input data and how it might affect the output

- There are multiple methods for qualitatively and quantitatively determining the weights (more on that later!)

APPLICATION

The most common way to apply MCE is through a weighted sum model, such as the Spatial Analyst tool in the ArcGIS

However, the same methods can be applied in any GIS software using the raster calculator or creating a unique model with raster algebra

Additional variables, such as opportunity cost, administrative boundaries, or ecosystem maps, can be combined with the MCE outputs to answer specific conservation questions

ARIES Explorer

https://www.youtube.com/watch?v=vsWGkMBpI9Y

- displaying spatial data (0-7 mins)
- mapping ecosystem services (7-15 mins)
- spatial scenarios analysis (15-17 mins)
- importing your own data and models (17-20 mins)

ANALYTICAL HIERARCHY PROCESS

Making the qualitative quantitative

BACKGROUND

The **analytic hierarchy process** (AHP) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. It was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then.

It is often applied in group decision making, and is used around the world in a wide variety of decision situations

Rather than prescribing a "correct" decision, the AHP helps decision makers and stakeholders find one that best suits their goal and their understanding of the problem

TECHNICAL RECOMMENDATIONS – PAIRWISE COMPARISON

Pairwise comparison is a technique were multiple criteria assessed on a one-to-one basis

Each pair of input variables is assigned a relative importance compared to another variable based on the preference of the decision maker

In the pairwise process illogical or contradictory preferences are identified

The final product of the pairwise comparison is a matrix that can be used to assign weights to input variable for MCE

APPLICATION

AHP can be applied in many ways using a range of different platforms from specialized software to Microsoft Excel to online portals

Given the flexibility and transparency of AHP, it is an ideal tool for engaging with stakeholders and group decision making

This website provides a good overview of AHP and tools: https://bpmsg.com/ahp/ahp.php (we will be using it later)

NEXT STEPS

- Learn about the Ecosystem Benefit Index developed in San Martin, Peru
- Apply MCE and AHP to develop land-use planning scenarios
- Review and discuss results and applications