##### [00:00:00.430] - Speaker 1

Welcome to this Community Viz Video Tutorial. This tutorial is about the optimizer decision tool. In this video we'll talk about the optimizer and what it does. We'll cover how to use the Optimizer Wizard, will talk about viewing results, and we'll give some additional information about the way Optimizer does fractional choices. The Optimizer is intended for advanced users who are already familiar with Community Viz.

##### [00:00:30.120] - Speaker 2

And comfortable with a certain amount of mathematical analysis.

##### [00:00:33.660] - Speaker 1

You may find that the Suitability Wizard meets your needs. They're both about evaluating features on the map according to characteristics. The Suitability Wizard simply gives every feature a score in terms of its suitability.

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The Optimizer goes a step further and says what is the best combination of features to choose to achieve some goal subject to overall resource limitations, such as, for example, a budget? Let's go through a conceptual example first. This one is often used to talk about optimization.

##### [00:01:08.250] - Speaker 2

It's how much ice you can put in a glass. And the message here is going to be that the best individuals are not always the best combination.

##### [00:01:16.890] - Speaker 1

So those are ice cubes on the left and this is a glass. Your first reaction might be to put the largest ice cubes in, but it turns out that doesn't work because you overflow the glass. A better solution is to put in the largest ice cube, but then also some of the smaller ones to get the optimal solution. That's a conceptual example. Here's a few planning examples.

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The most classic is which parcels to conserve. Given a budget, you're trying to maximize your conservation value, but you only have so many dollars to spend. Another example is let's say you had to choose three retail sites that together. Serve the most people but also take up less than ten acres of land. And then the third example is a more complex but real world example in which you're trying to decide which projects to develop and you want to get maximum yield, but you also have minimum requirements for a mix of residential and commercial.

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So let's look at a real example in Community Viz. I'm looking at an existing analysis that I've already been working on. The colored parcels are different kinds of open space, and in particular the purple ones are community gardens. The hypothetical story of this demonstration is that I want to raise money and purchase that land outright for a foundation that's going to maintain those community gardens in perpetuity. To make the analysis easier to understand, I've exported those features into their own layer called community gardens. I can find the optimizer wizard on the Scenario 360 Decision Tools toolbar. It looks like this that's also available from the Scenario 360 drop down menu. Tools Menu for purposes of this demo, I'm going to use an existing optimization I've already set up. Optimizations are saved as an indicator. I could also set up a new one or run an existing one. And the one I've set up is called garden preservation. Now, it's in the layer of community gardens, and what I want to achieve with this is to maximize the total acreage of community gardens, given the budget that I've given myself. So I chose this attribute in community gardens called acreage, and I said, maximize it. I need the wizard to tell me which features to select. That's the result attribute, and it's going to create that attribute and populate it for me. I asked it to put it in.

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An attribute called optimal fraction. If I didn't have that attribute already, set up an empty one ready for me to go, I could set up a new attribute right here and then use it by choosing it from this list. Next, I have to set up my constraints. In my case, I just have one constraint. It's about the budget. And what I said is the total assessed value needs to be less than my variable assumption for budget. I can add more constraints if I wish. The way constraints work is they sum up all the attributes for the selected.

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Features, and then you can do less than, equal to, et cetera. Finally, on the last page of the wizard, I select my run options, and then I'm ready to look at my results. When the wizard first completes, I can't see anything on the map. However, if I look in the attribute table, I can see results in the particular attribute. I asked results to be populated into, in this case, optimal fraction. If I want to see those on the map, I may want to change my symbology appropriately. For purposes of this demo, I've set up some charts and assumptions to help me illustrate what's going on. You have to set these up yourself. The wizard doesn't do it for you. So, here's my new symbology. I have green for the community gardens that the optimizer has chosen for me, and that's based on this budget, which goes from zero to $25 million. I've also got a couple of charts here. This is my budget, and next to it is the cost of the features that were actually selected.

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You'll notice right now the cost is less than the budget, which is good, and some tracking statistics how many acres I've managed to purchase, the number of community gardens I've purchased, and the cost I'm paying per 10th of an acre. Now, I have left the optimizer set to update when anything else changed. So if I were to change my budget and run an update, the optimizer runs again, and I get new results here. Now, my budget is $39 million, and my total expense is $38.9. You can see here that the wizard is selecting a number of parcels. It's not always the largest, not always the smallest. It's the right combination to fit as perfectly as possible into my budget while maximizing total acreage. This kind of optimization is computationally intensive. The optimizer runs very quickly on small computers. But it does that by taking a kind of shortcut that you should be aware of. If you look at this optimal fraction attribute, you'll see one in the features that have been selected. That's how these are turning green. And you'll see a lot of zeros and features that have not been selected. You'll also always find one feature that has a fractional result that's a number between zero and one, which is the optimizer saying it would like to choose part of that feature that may or may not be realistic in real planning situations.

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To illustrate what's going on here, I've added some more to my analysis. I've set up a variable assumption that either uses or doesn't use that fractional choice. So if I change my result, my analysis to use that fraction and update once again. What you'll notice is that my cost and budget now match exactly that's because the optimizer took just part of a feature and filled in the gap, so that allowed it to run much faster. It produces very good results, but they may not be mathematically perfect, and you should be aware of that depending on your particular needs. Thank you for watching this community Vis video Tutorial. For more video tutorials and Community Viz resources, please visit the website.