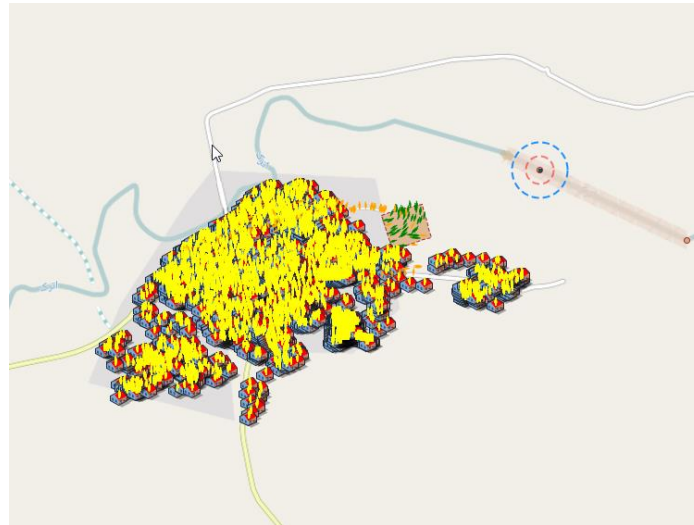


Disaster Simulation: An AnyLogic Agent-Based Simulation Approach

**Example:
Flood simulation and evacuation
GIS Environment**



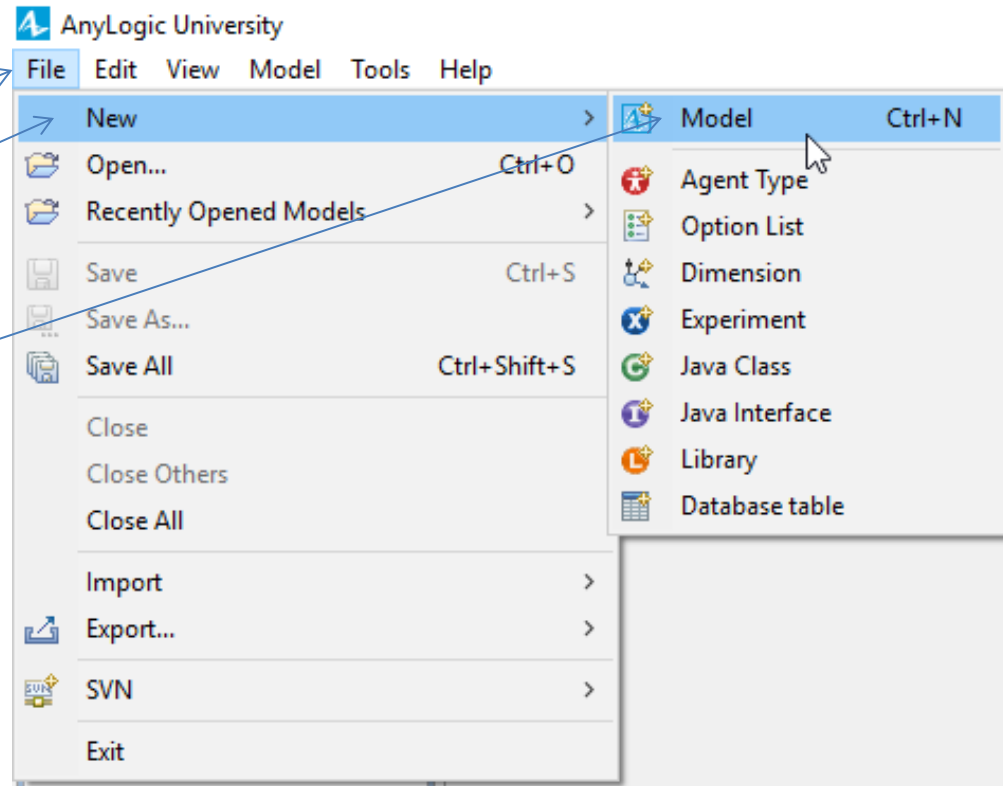
Ali Asgary
ADERSIM
York University
2017

Lesson 1: Creating a base model

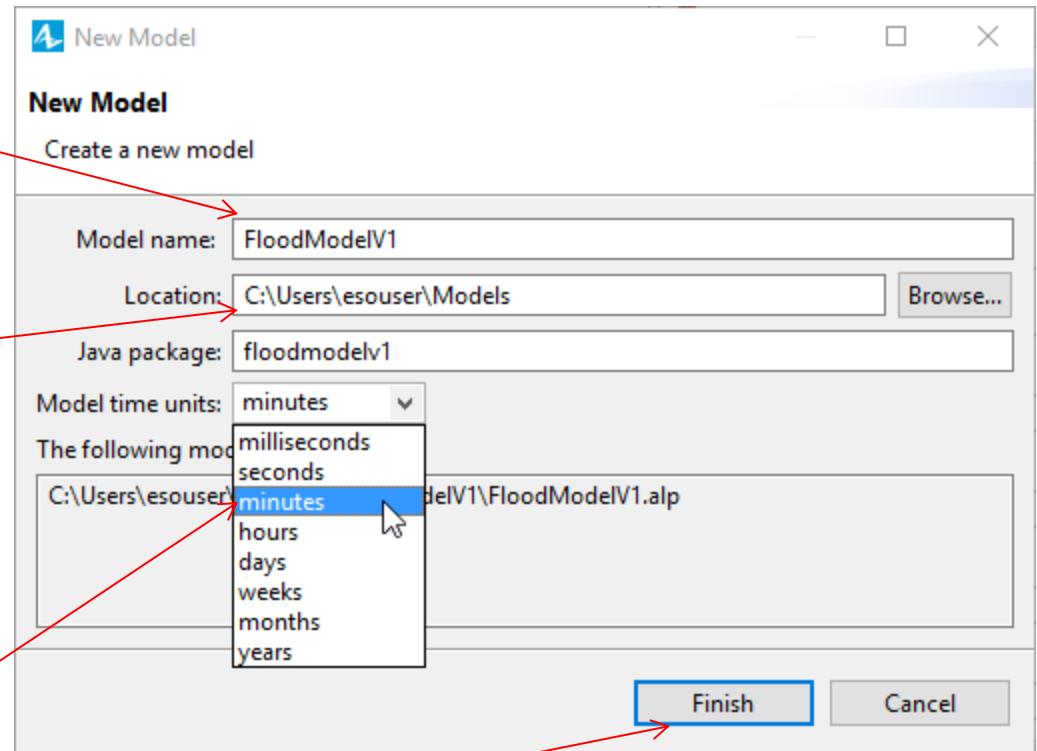
- Creating the agents
- Creating agents environment (GIS environment)
- Creating agent population

Create a model

- From the File menu choose New and select Model

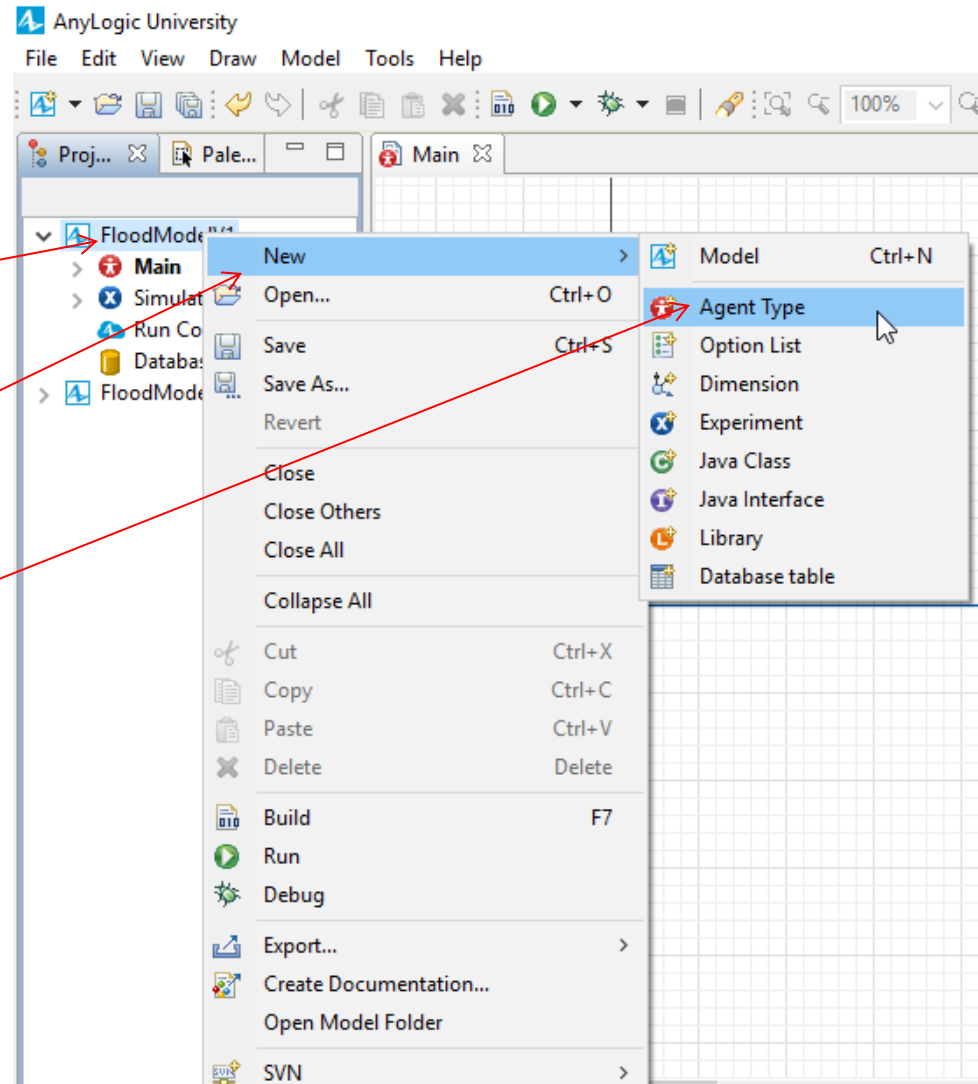


- Use FloodModelV1 as Model name
- Select the directory where you would like to save your model
- Choose “minutes” as your model time units
- Press Finish



Creating Flood agent

- Right click on your FloodModelV1 model
- Choose New
- Choose Agent Type



- Use *Flood* for the Agent type name.
- Click *Finish* to continue.

New agent

Step 1. Creating new agent type

Agent type name:

Create the agent type "from scratch"

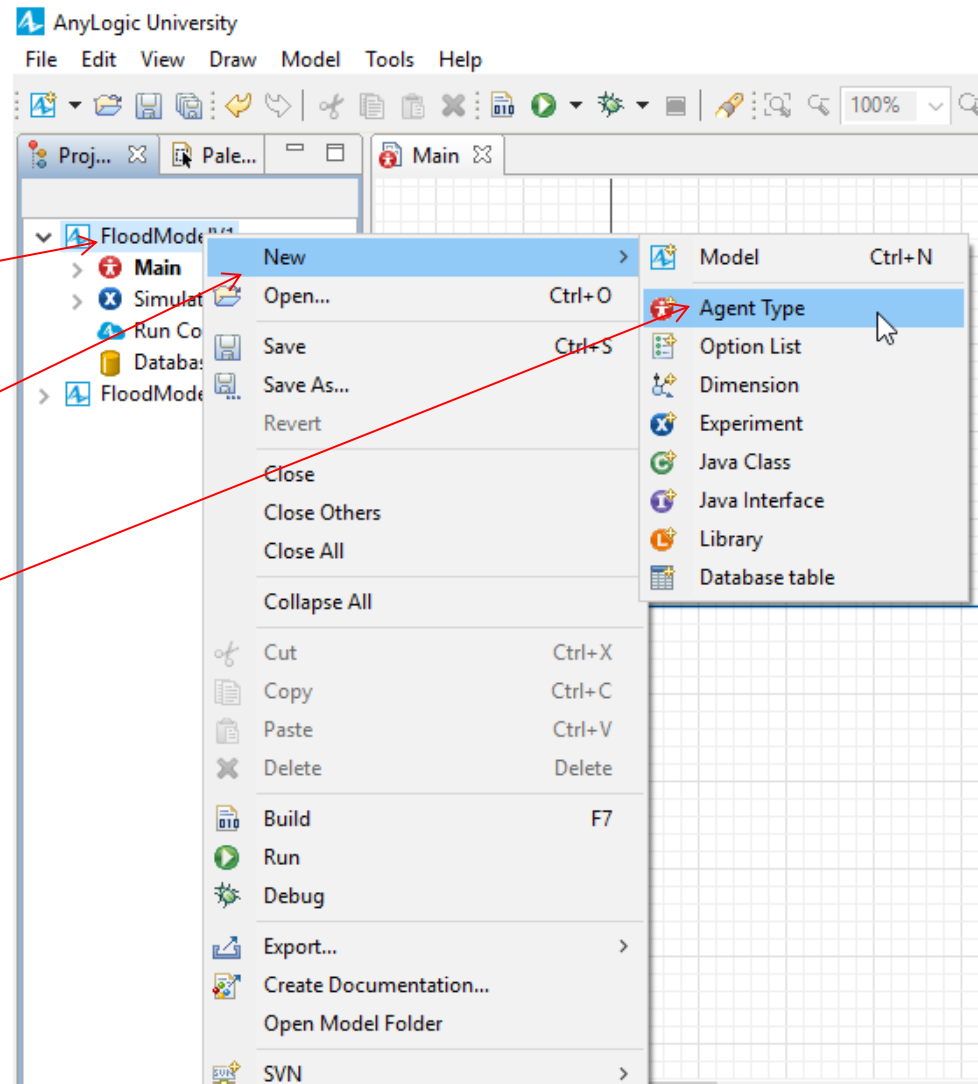
Use database table
I have agent data stored in a database

Agent will be used in flowcharts

< Back Next > **Finish** Cancel

Creating Property Agent

- Right click on your FloodModelV1 model again
- Choose New
- Choose Agent Type



- Use *Property* for the Agent type name.
- Click *Finish* to continue.

New agent

Step 1. Creating new agent type

Agent type name:

Create the agent type "from scratch"

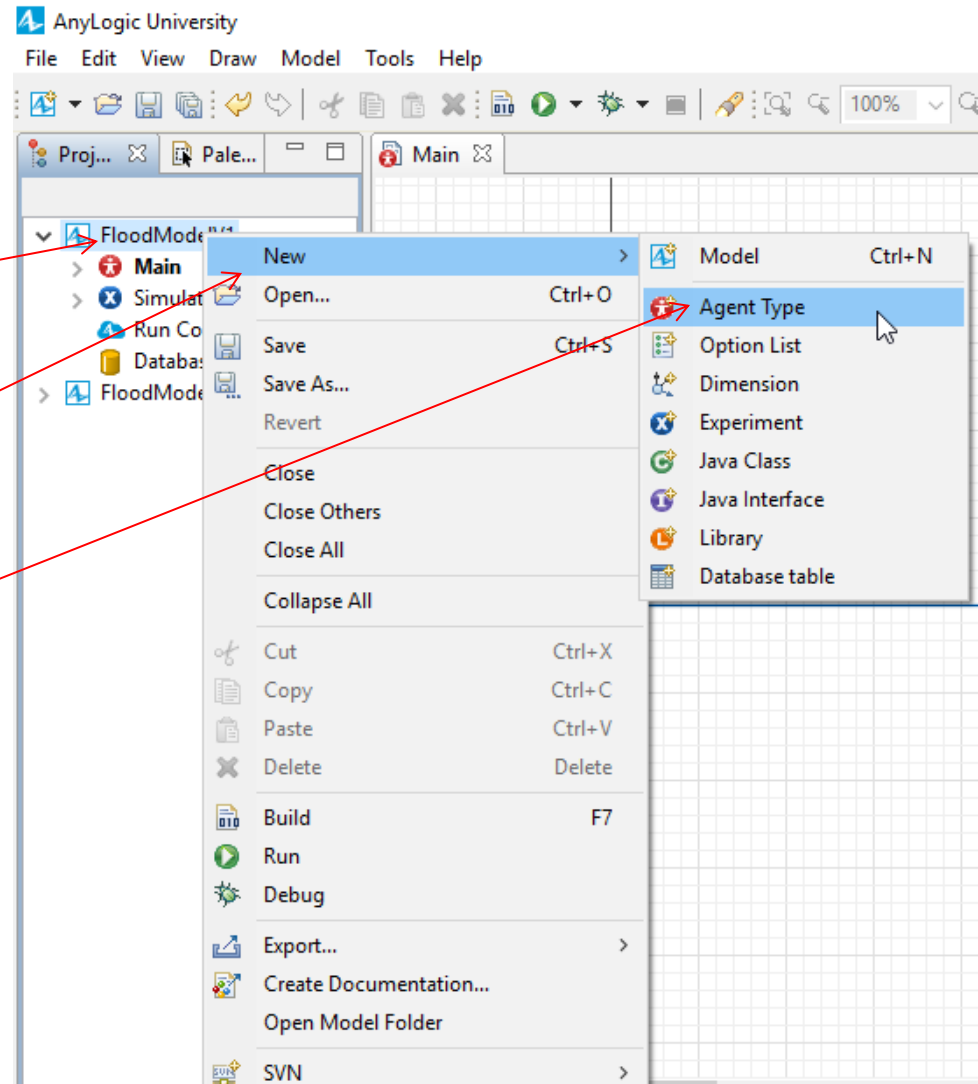
Use database table
I have agent data stored in a database

Agent will be used in flowcharts

< Back Next > Finish Cancel

Creating Person Agent

- Right click on your FloodModelV1 model again
- Choose New
- Choose Agent Type



- Use *Pesron* for the Agent type name.
- Click *Finish* to continue.

New agent

Step 1. Creating new agent type

Agent type name:

Create the agent type "from scratch"

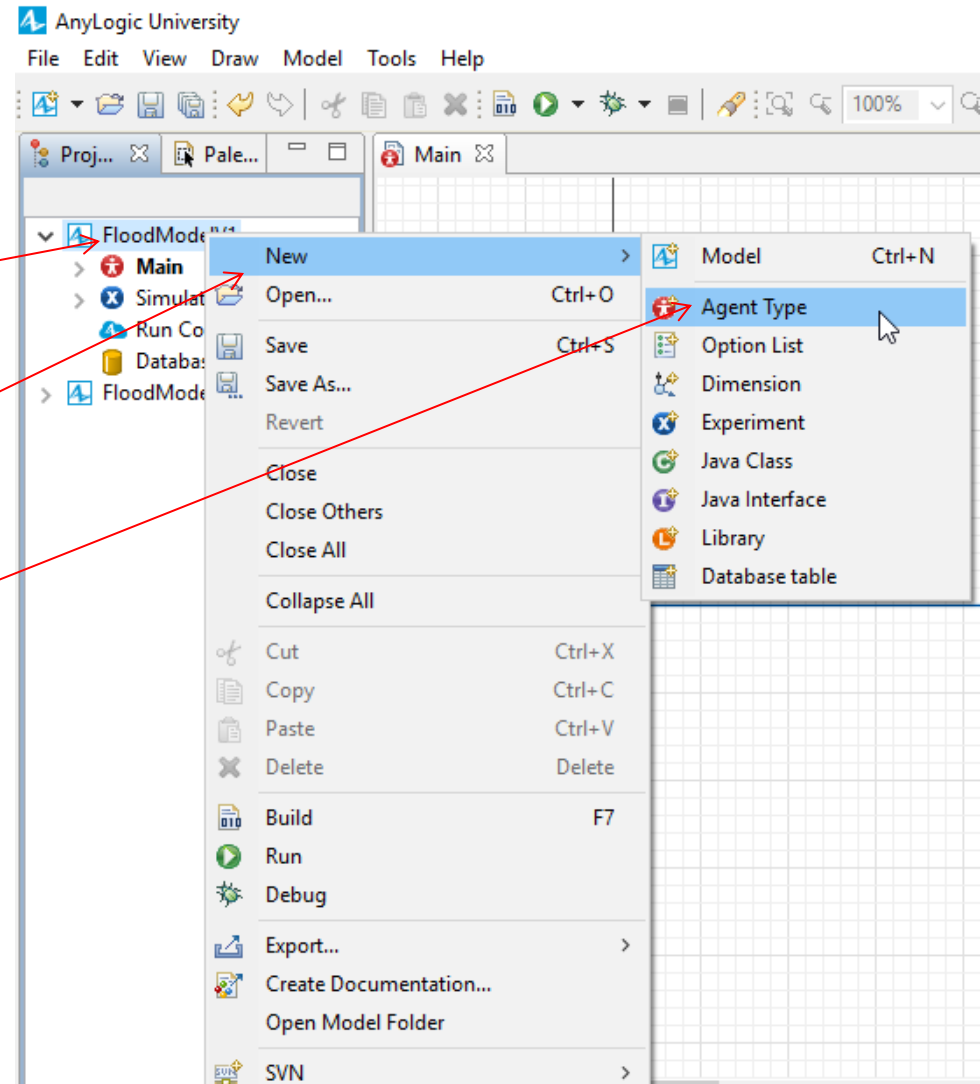
Use database table
I have agent data stored in a database

Agent will be used in flowcharts

< Back Next > Finish Cancel

Creating Sensor Agent

- Right click on your FloodModelV1 model again
- Choose New
- Choose Agent Type

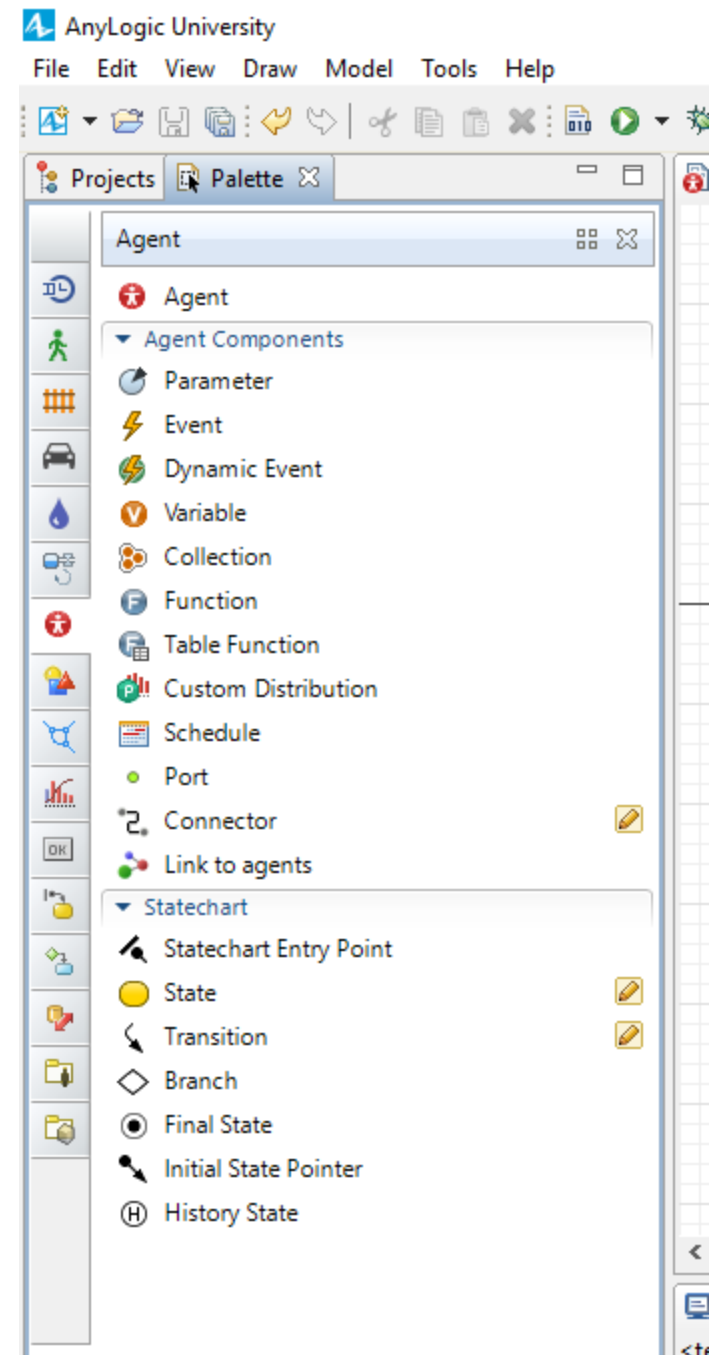
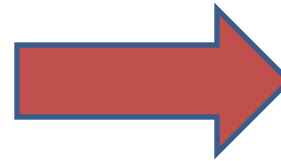
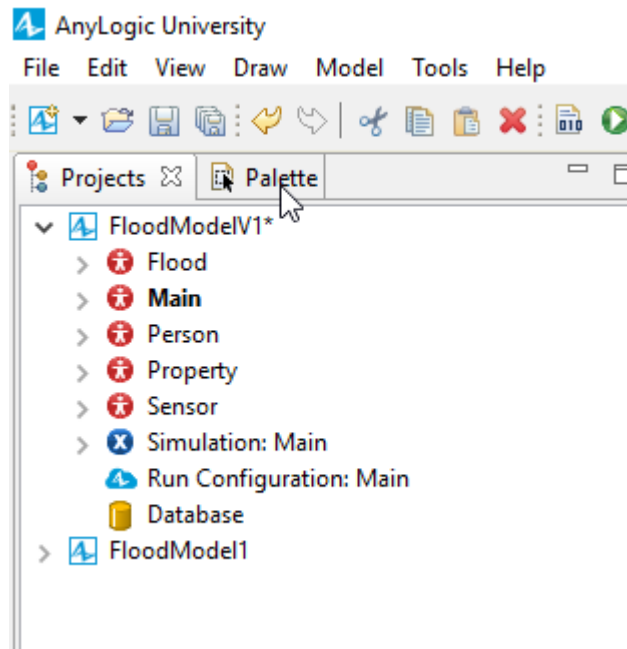


- Use *Sensor* for the Agent type name.
- Click *Finish* to continue.

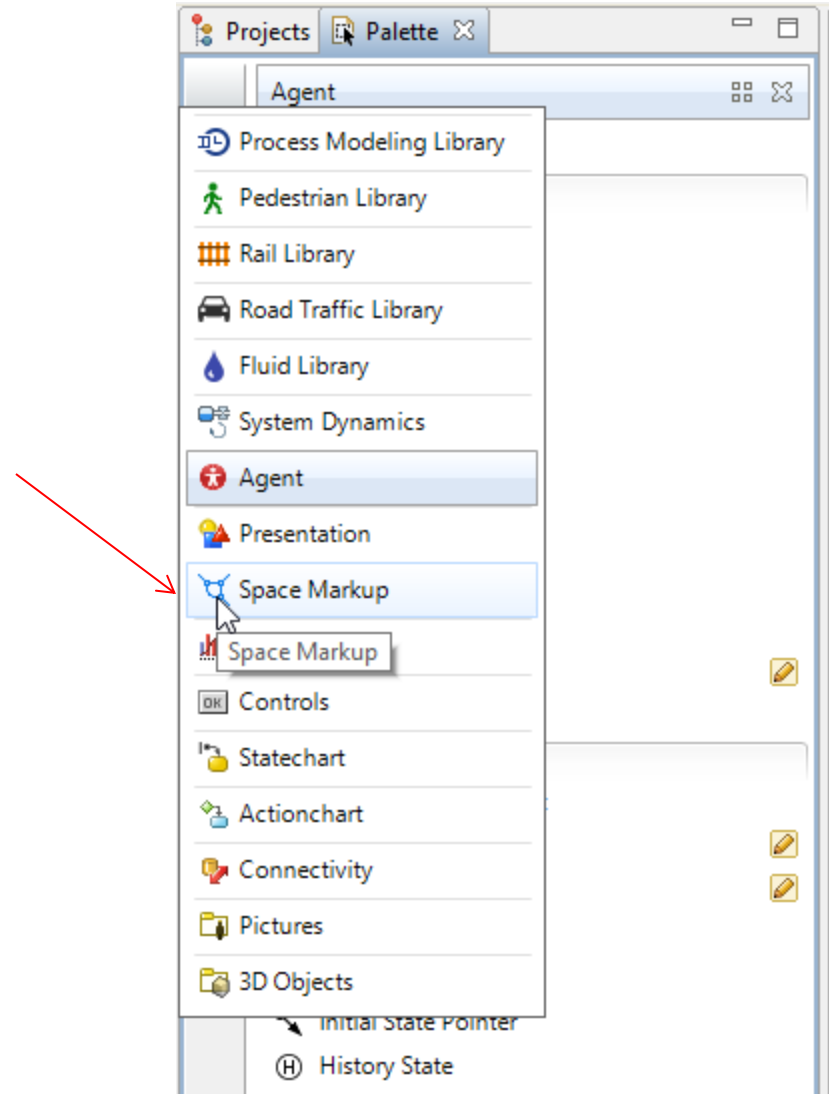
The screenshot shows a window titled "New agent" with standard Windows window controls (minimize, maximize, close). The main heading is "Step 1. Creating new agent type". Below this, there is a text input field labeled "Agent type name:" containing the text "Sensor". Underneath the input field are three radio button options: "Create the agent type 'from scratch'" (which is selected), "Use database table" (with the subtext "I have agent data stored in a database"), and "Agent will be used in flowcharts" (with an unchecked checkbox). At the bottom of the dialog, there are four buttons: "< Back", "Next >", "Finish" (which is highlighted with a blue border), and "Cancel". Two red arrows originate from the text in the list on the left: one points from "Sensor" to the input field, and the other points from "Finish" to the "Finish" button.

Creating the Environment (GIS) for agents

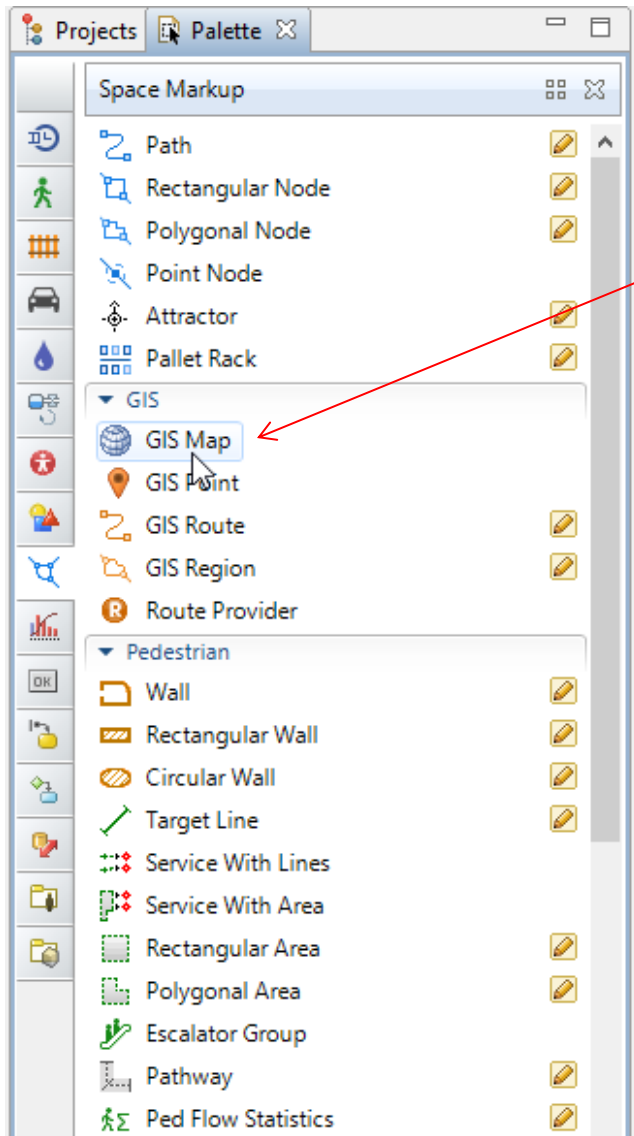
Choose Palette Tab to open AnyLogic tools



- To create a GIS map as an environment click on the Space Markup tools

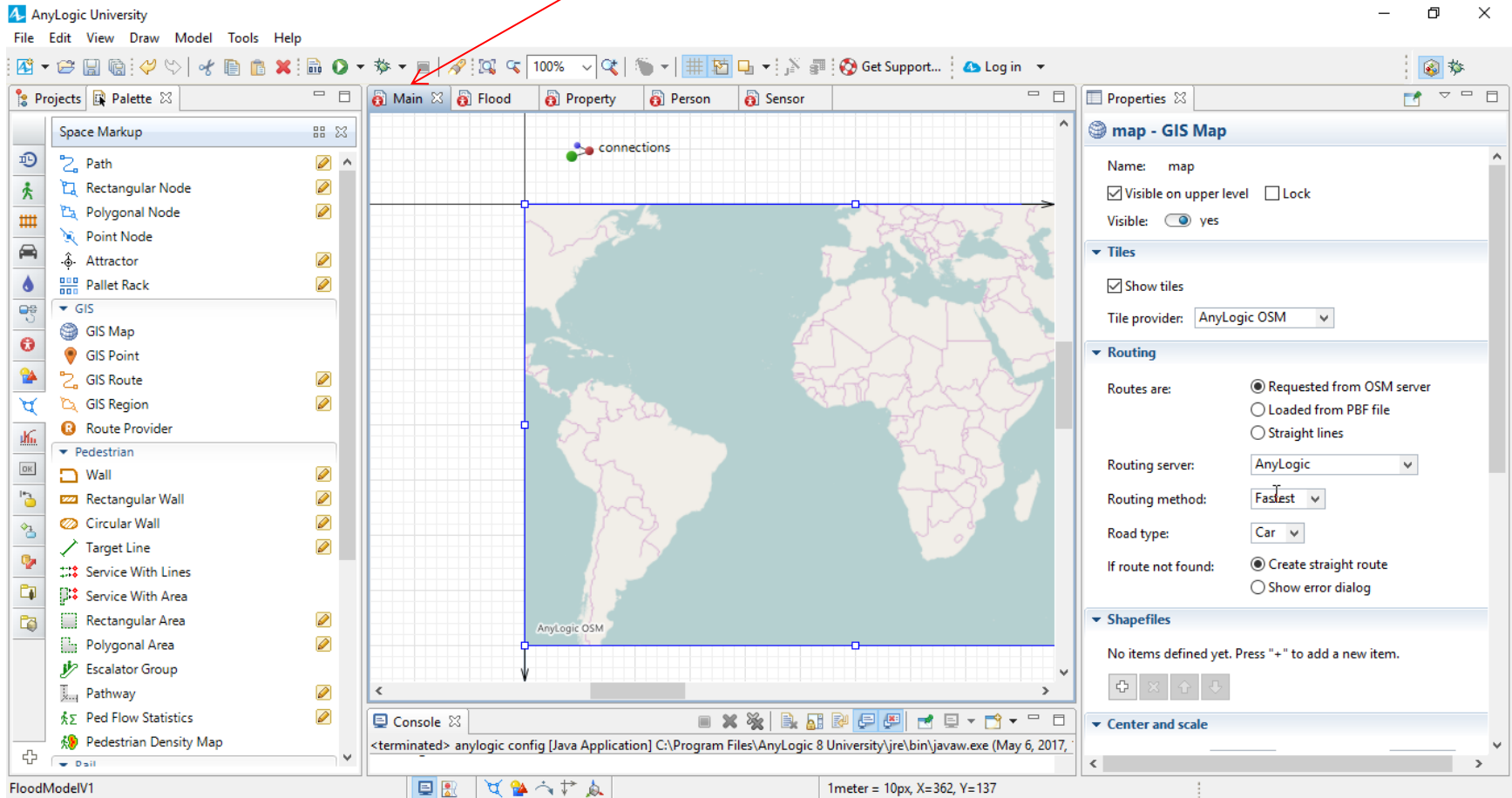


- Open Space Markup tool and select GIS Map.



Drag a GIS Map into your Main section of the model.

Your Model will look like this

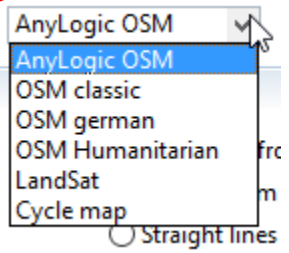


• Changing Map attributes

- Change the name of your map if you like. We leave unchanged .

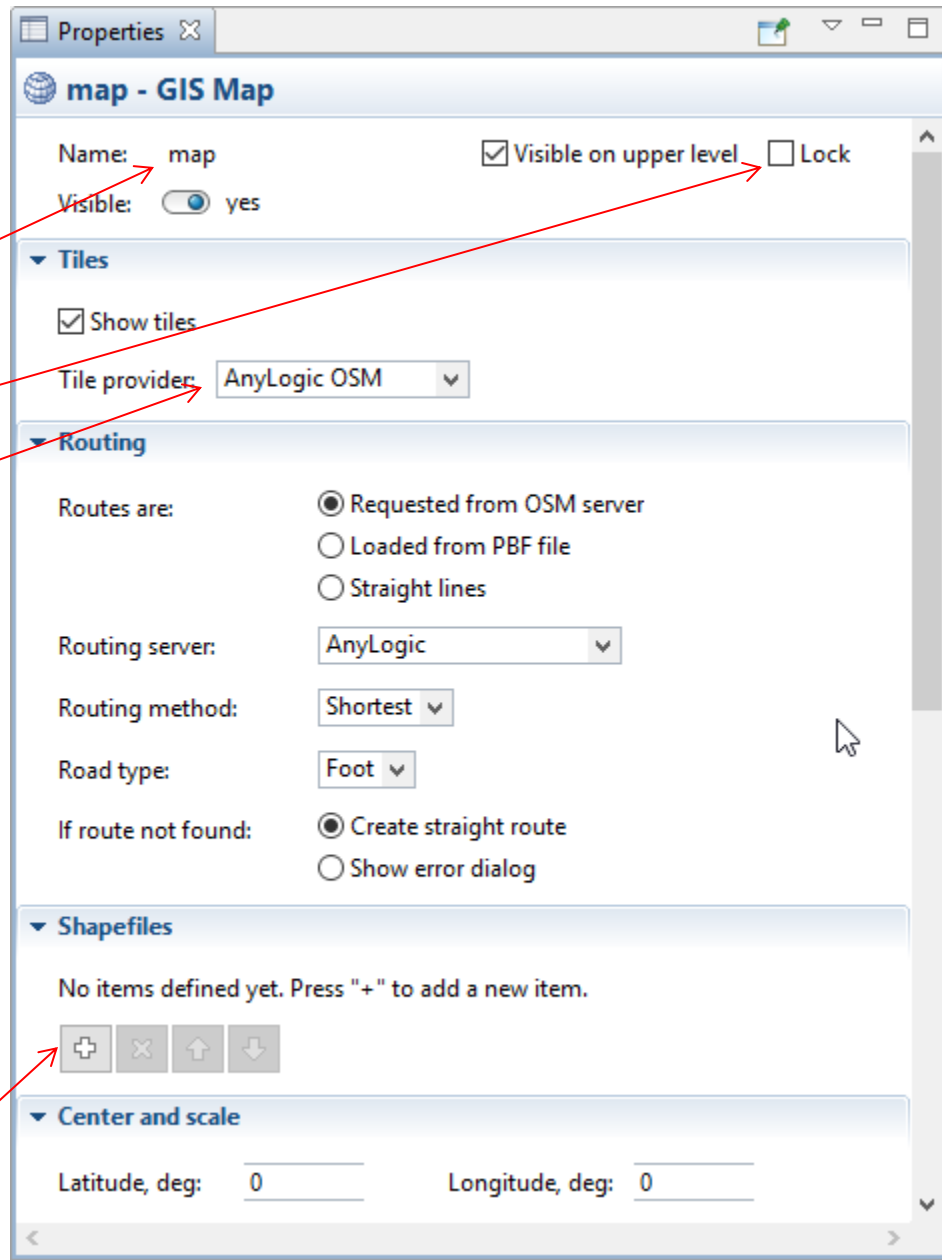
You can lock your map by checking the lock box.

You can change the Tile provider if you like. This is the list:



You can also change the routing which is used for agents movement in your model. We use OSM server, provided by AnyLogic server, using Shortest method and using road type Foot for now

We can add and use shapefile to our GIS map. (in future lessons)



- Changing Map attributes (continued)

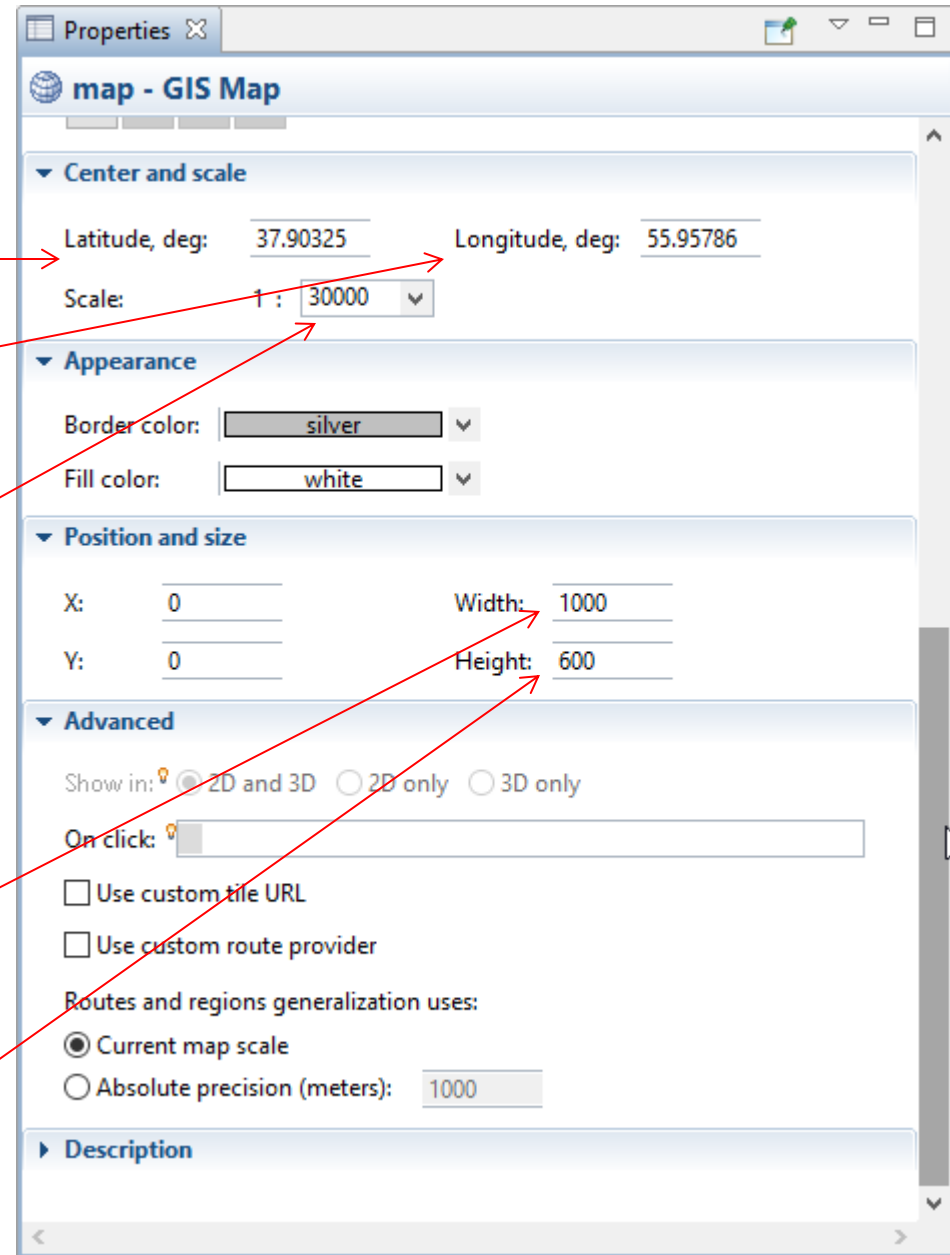
- Change the latitude to: 37.90325

- Change the Longitude to: 55.95786

- Change the Scale to 30000

- Increase the Width to 1000

- Increase the Height to 600



Your Model after these changes

The screenshot displays the AnyLogic University interface. The main window shows a GIS map titled "map - GIS Map" with a flood simulation overlay. The map features a city grid, a river, and a shaded area representing the flood zone. The flood zone is outlined in yellow and filled with a light blue color. The text "مراوده تپه" is visible on the map. The interface includes a menu bar (File, Edit, View, Draw, Model, Tools, Help), a toolbar, and a console window at the bottom. The console shows the message: "<terminated> anylogic config [Java Application] C:\Program Files\AnyLogic 8 University\jre\bin\javaw.exe (May 6, 2017, 1:11:14 AM)".

The left sidebar shows the project structure:

- FloodModelV1*
 - Flood
 - Main
 - Person
 - Property
 - Sensor
 - Simulation: Main
 - Run Configuration: Main
 - Database
 - FloodModel1

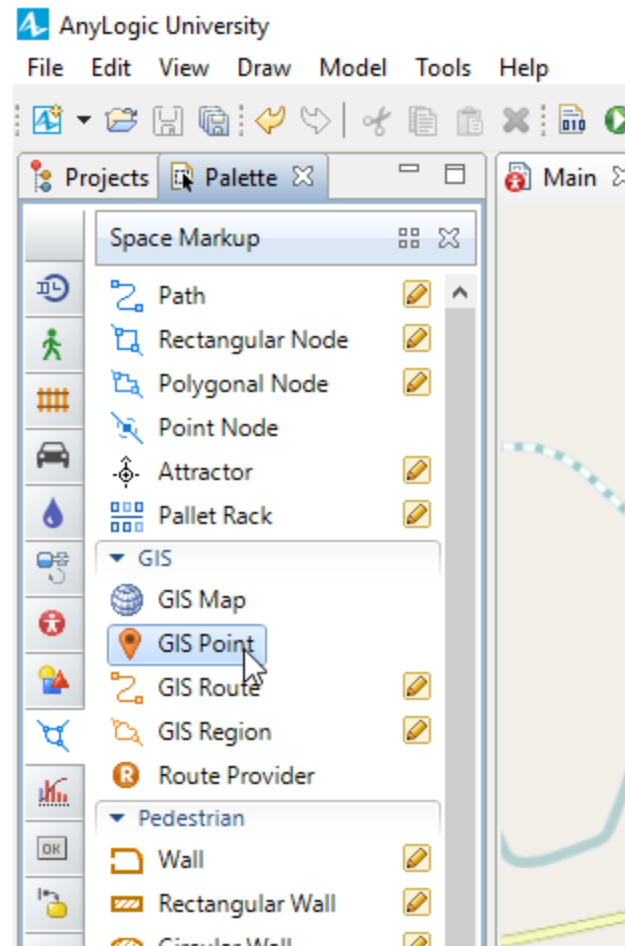
The right sidebar shows the Properties panel for the selected map:

- Center and scale
 - Latitude, deg: 37.90325
 - Longitude, deg: 55.95786
 - Scale: 1 : 30000
- Appearance
 - Border color: silver
 - Fill color: white
- Position and size
 - X: 0
 - Y: 0
 - Width: 1000
 - Height: 600
- Advanced
 - Show in: 2D and 3D 2D only 3D only
 - On click: [text field]
 - Use custom tile URL
 - Use custom route provider
 - Routes and regions generalization uses:
 - Current map scale
 - Absolute precision (meters): 1000
- Description

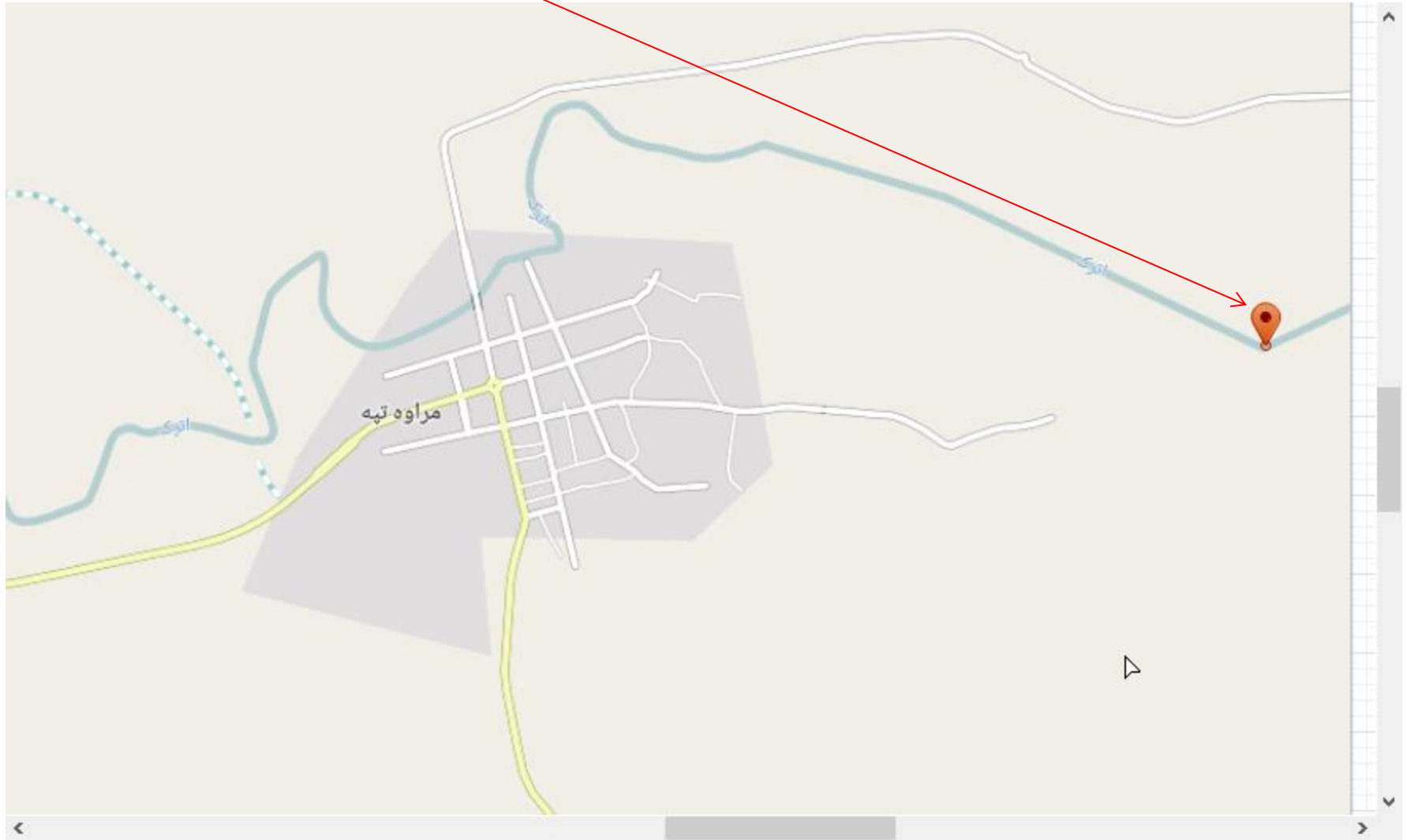
Determining the starting and ending point of flood simulation

- We will add to GIS point in the river to indicate the beginning and the end of our river simulation.
- We make these point for simplification at this time. In a more advanced model we can change it

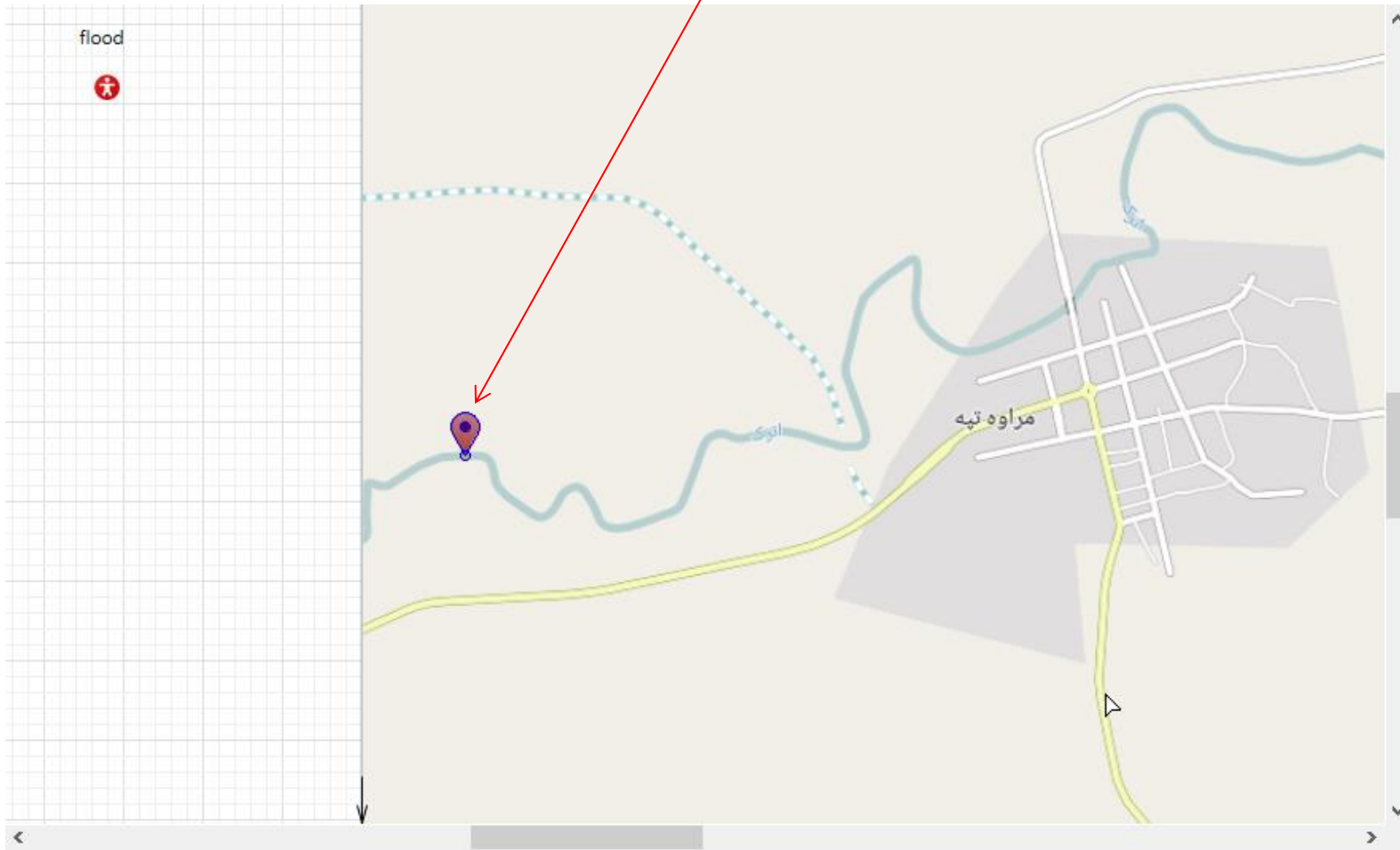
- From the Palette Choose space Markup and then choose GIS Point



- Drag a GIS Point in to the river as shown

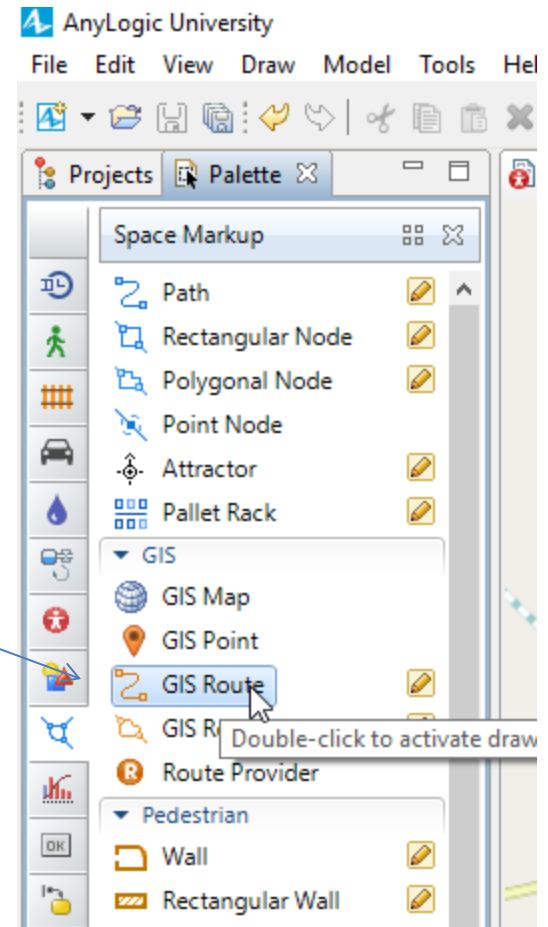


Drag another GIS Point to the other end of the river as shown

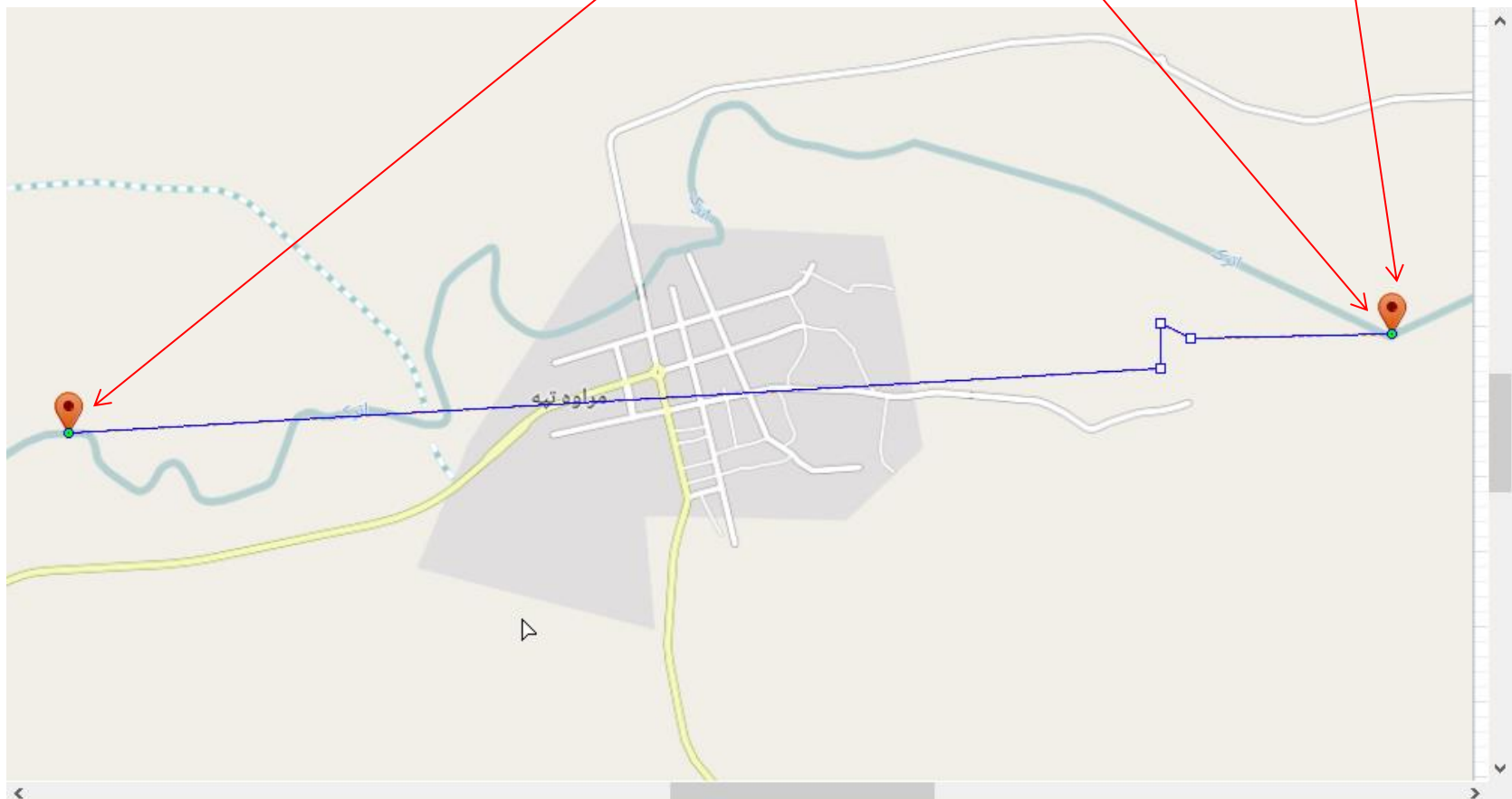


Creating the River

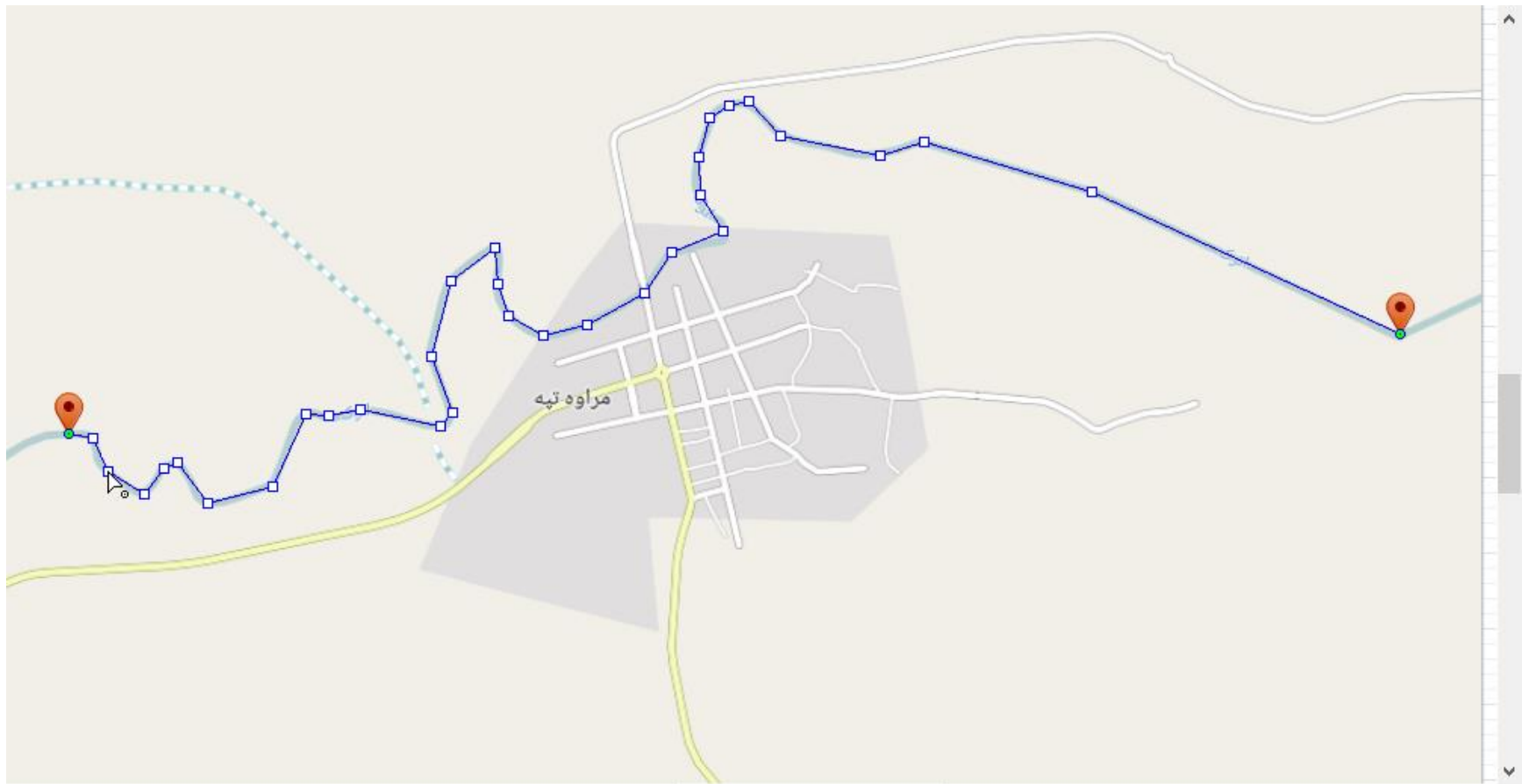
- Using the GIS Route Tool we will create the river now. It is like drawing the river
- Drag a GIS Route from the space markup to your map



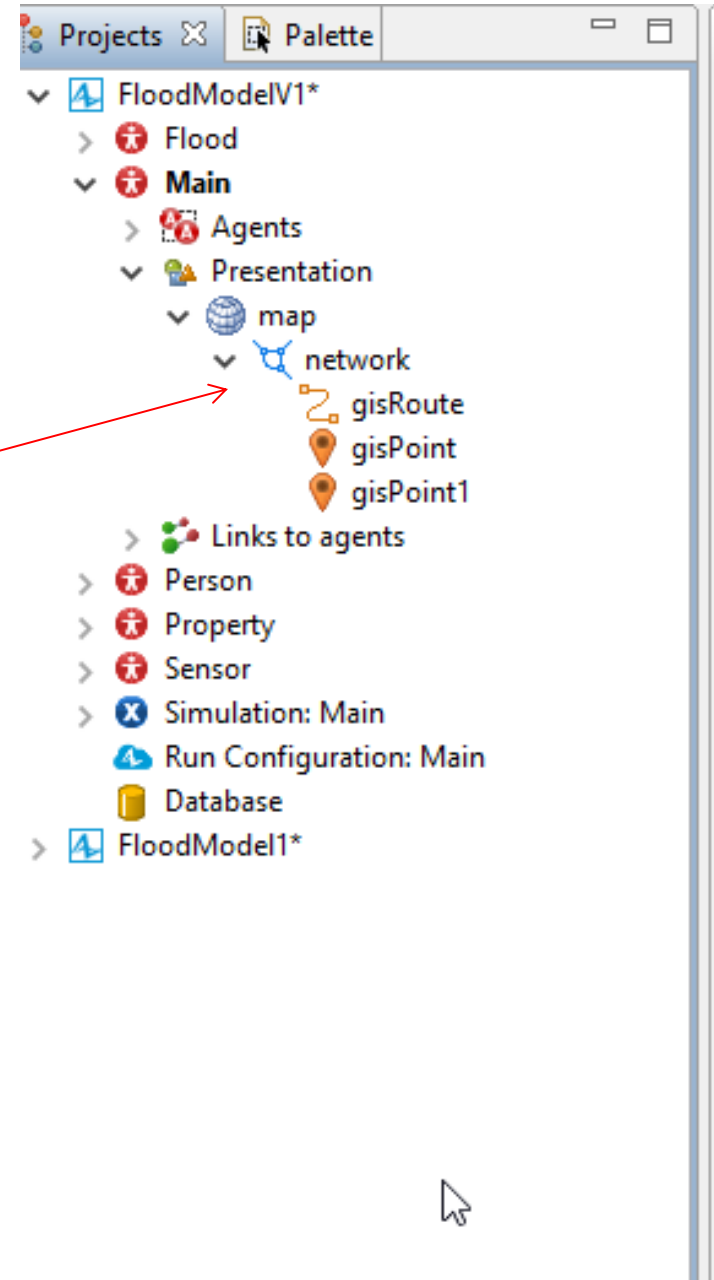
- Connect one head of your GIS Route to the first GIS Point and the other end to the second GIS Point. When connected it is shown by green dot color



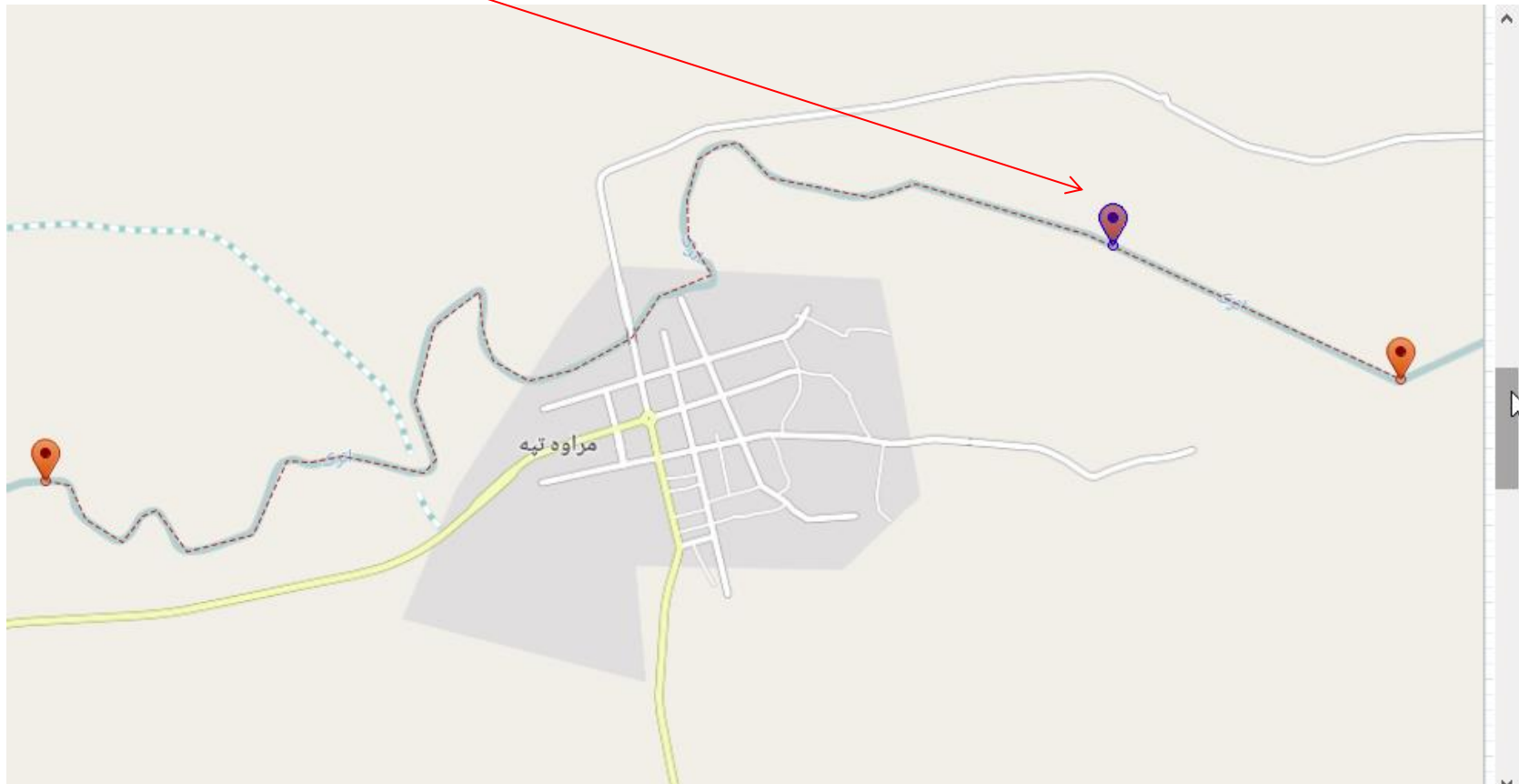
Now, you can double click on the GIS Route to create new segments and align the route to the river as shown



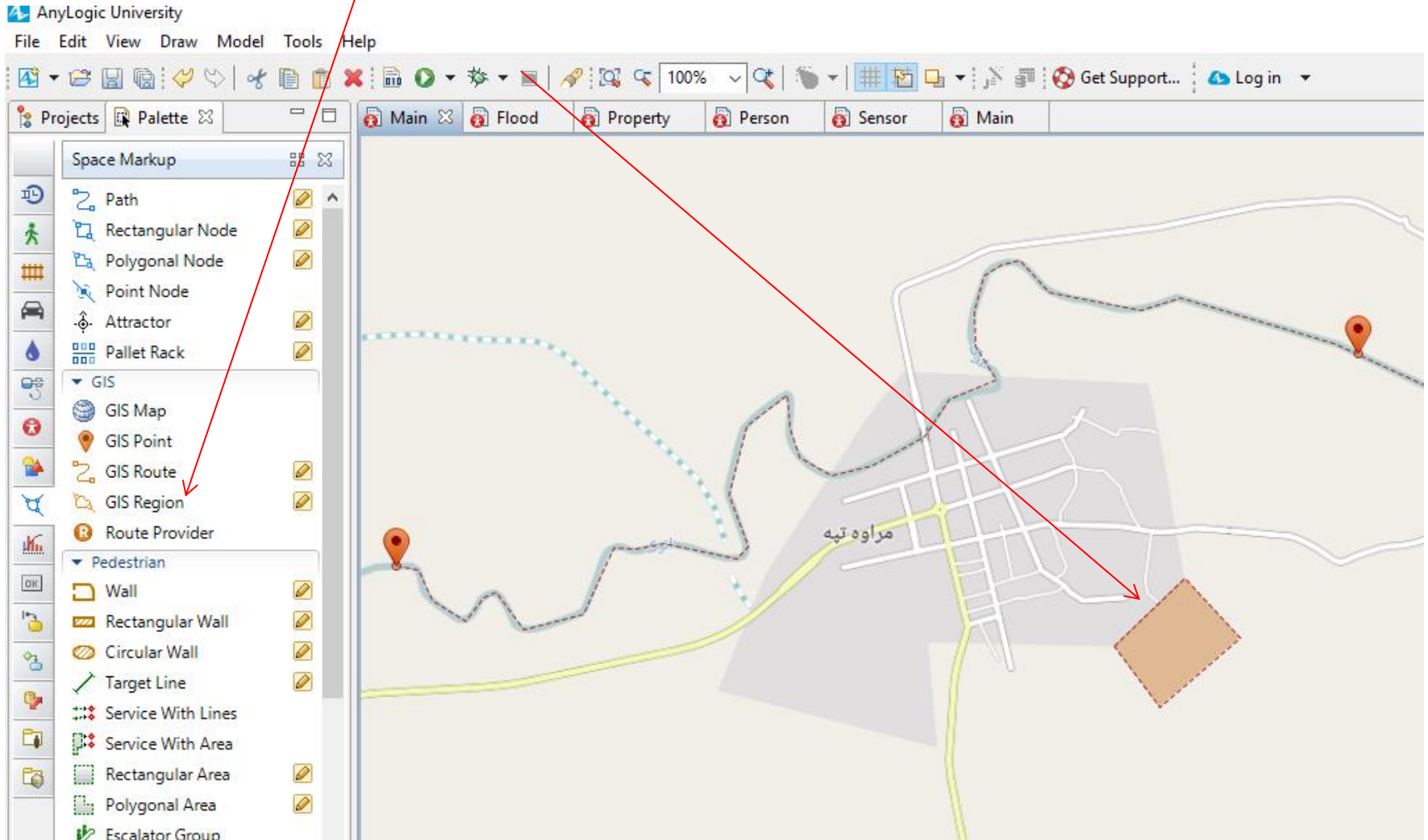
If these three GIS elements (gisPoint, gisPoint1, and gisRoute) are correctly connected they create a network). You can expand your Model to see the network.



- Add another GIS Point to represent the location of our Flood level Sensor. Drag a GIS Point from the Palette and put it somewhere in the river as shown:

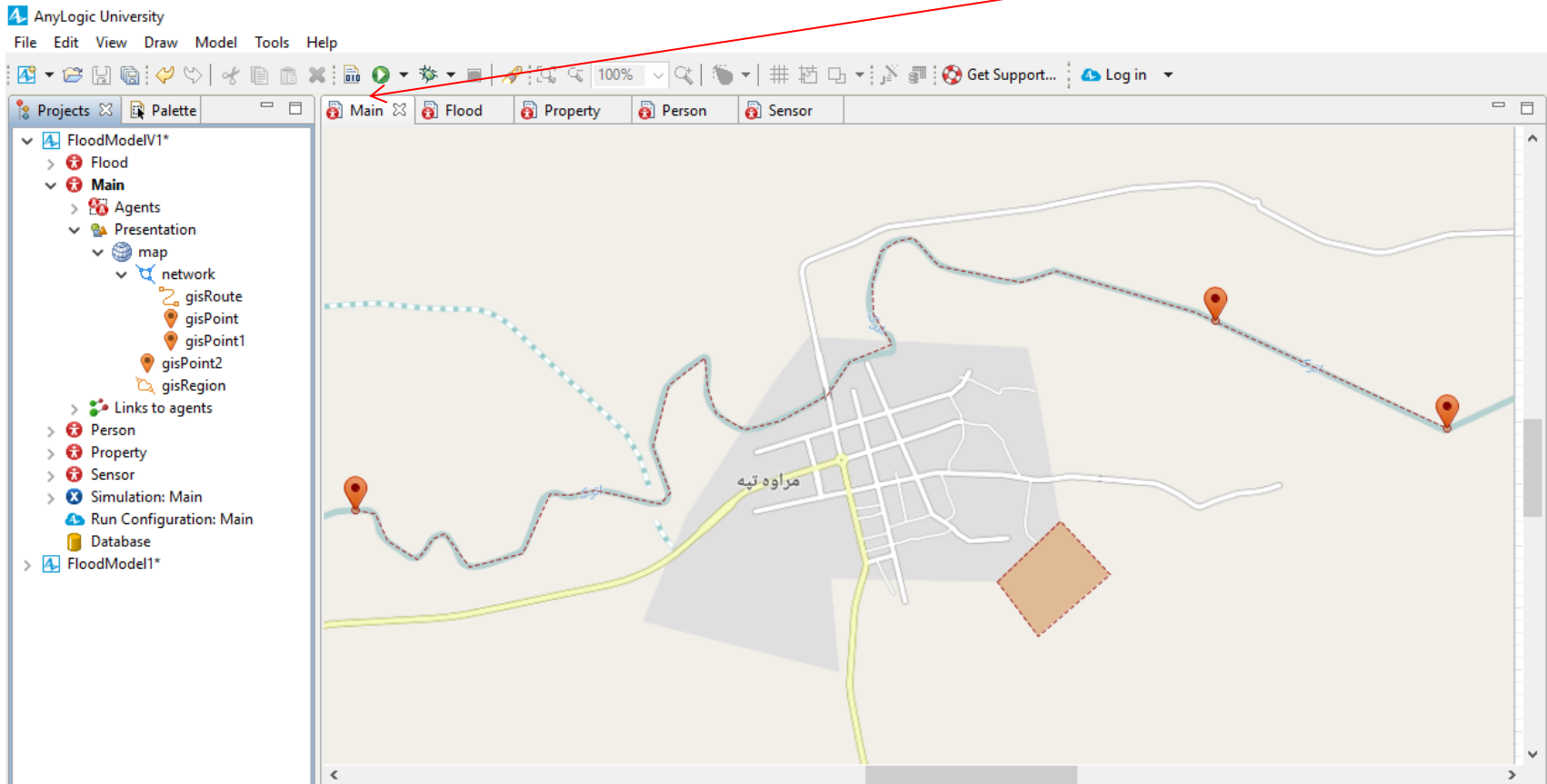


- Add a GIS Region to your map by dragging a GIS Region from the Palette to indicate the flood evacuation safe area.

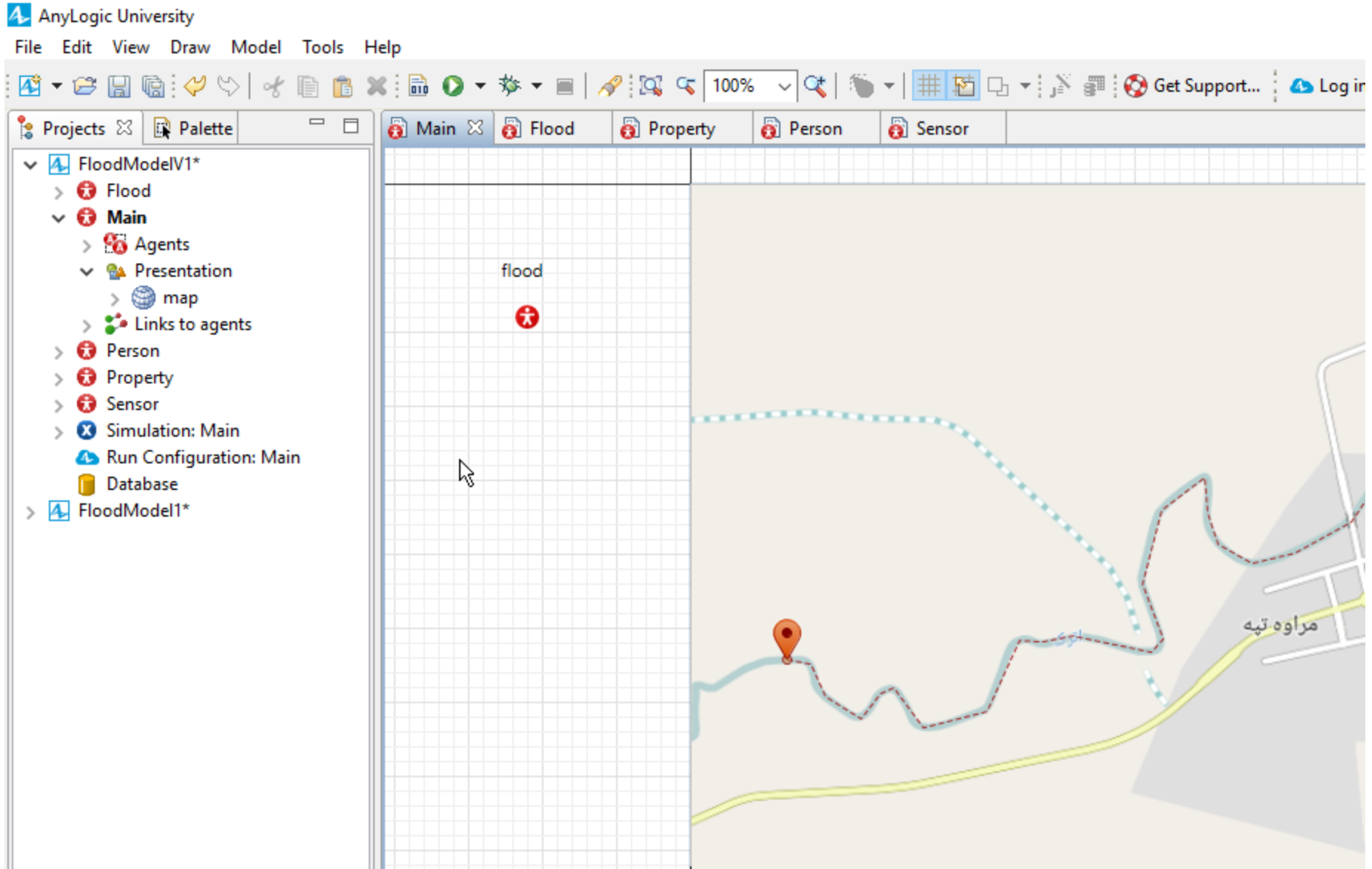


Adding and defining Agents populations

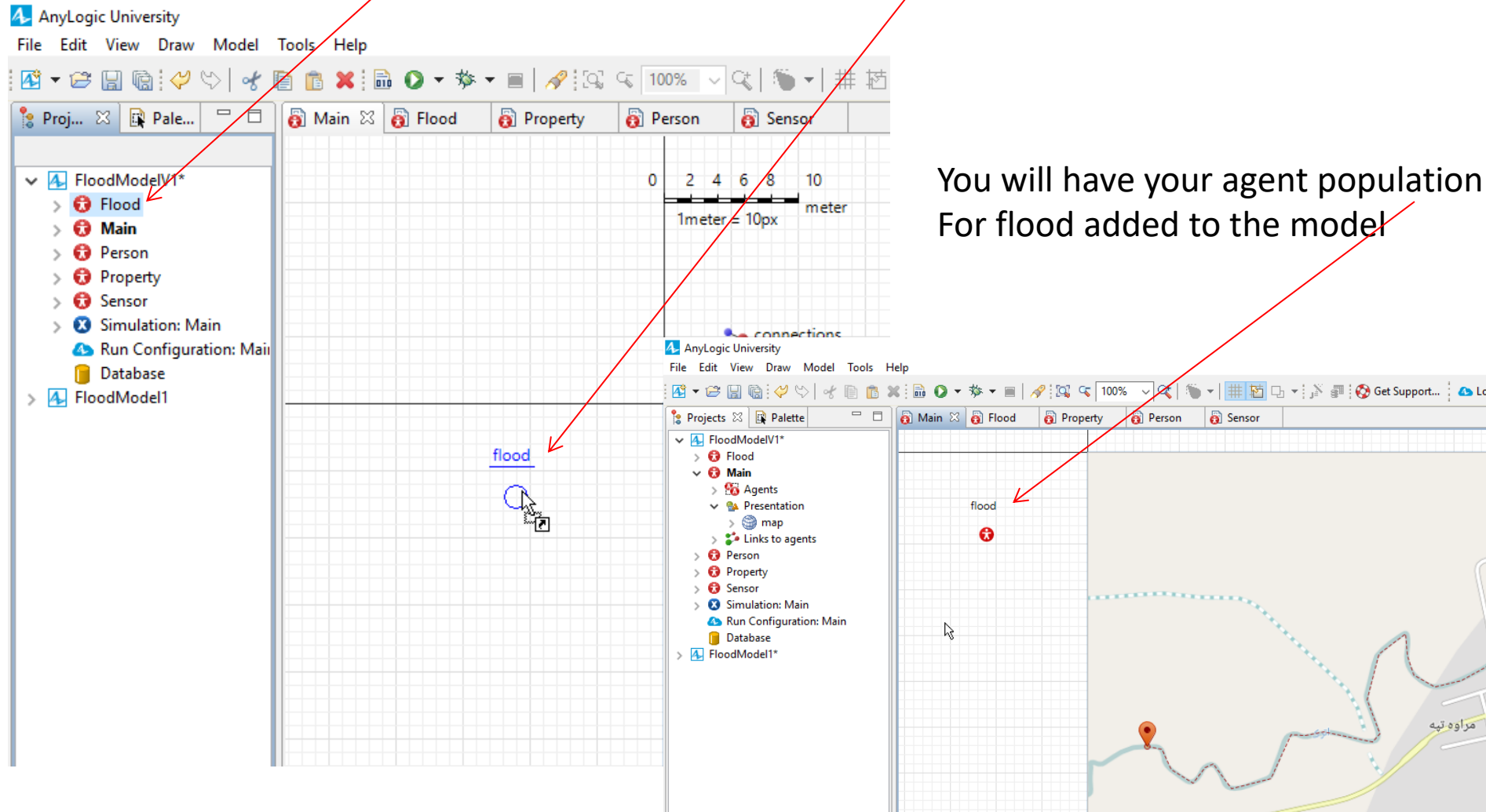
- Our Model should look like this now.
- Our next step is to add agents population to the Main Tab



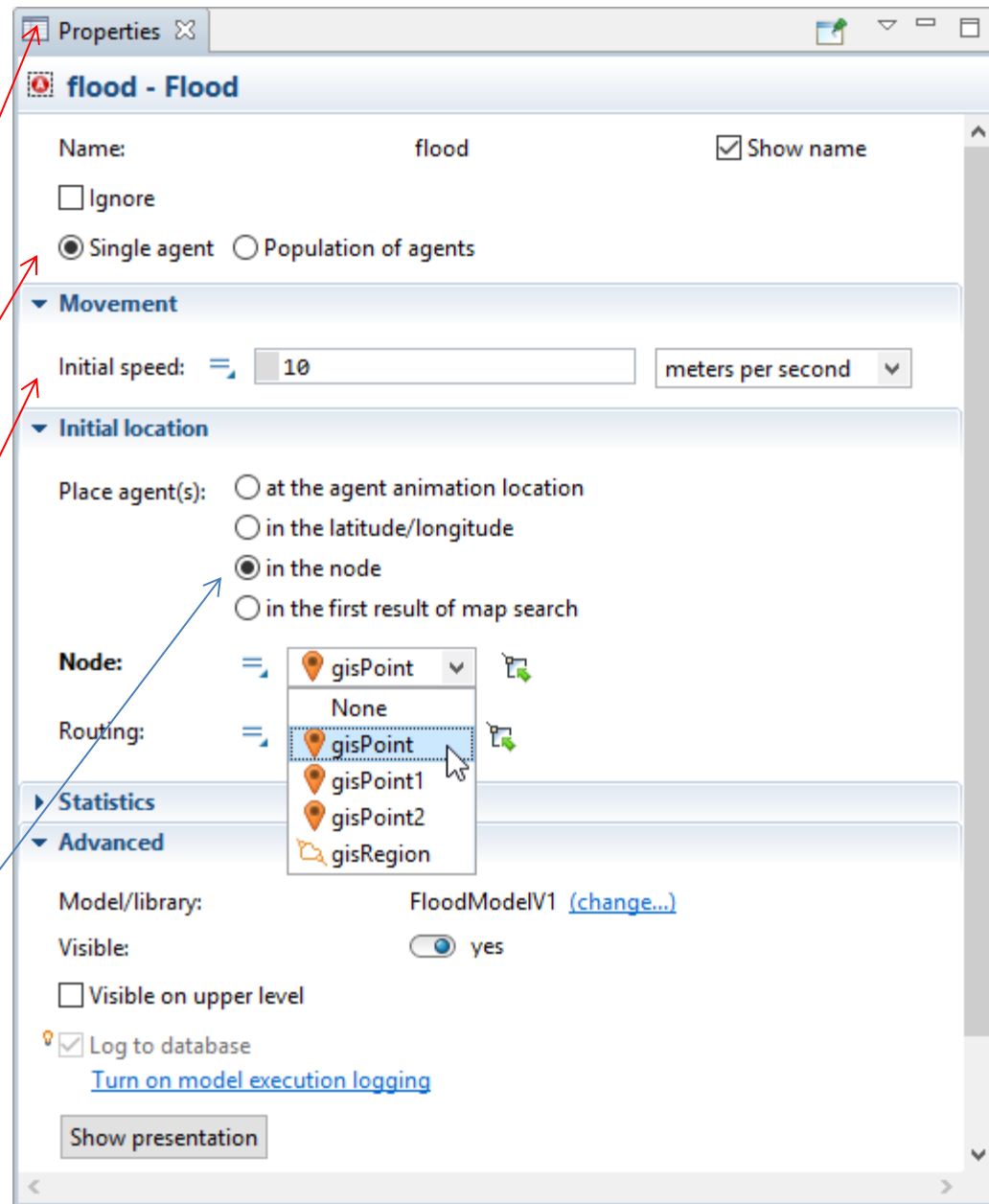
- Open the Main tab or window



- Click on your Flood agent and drag it to the Main

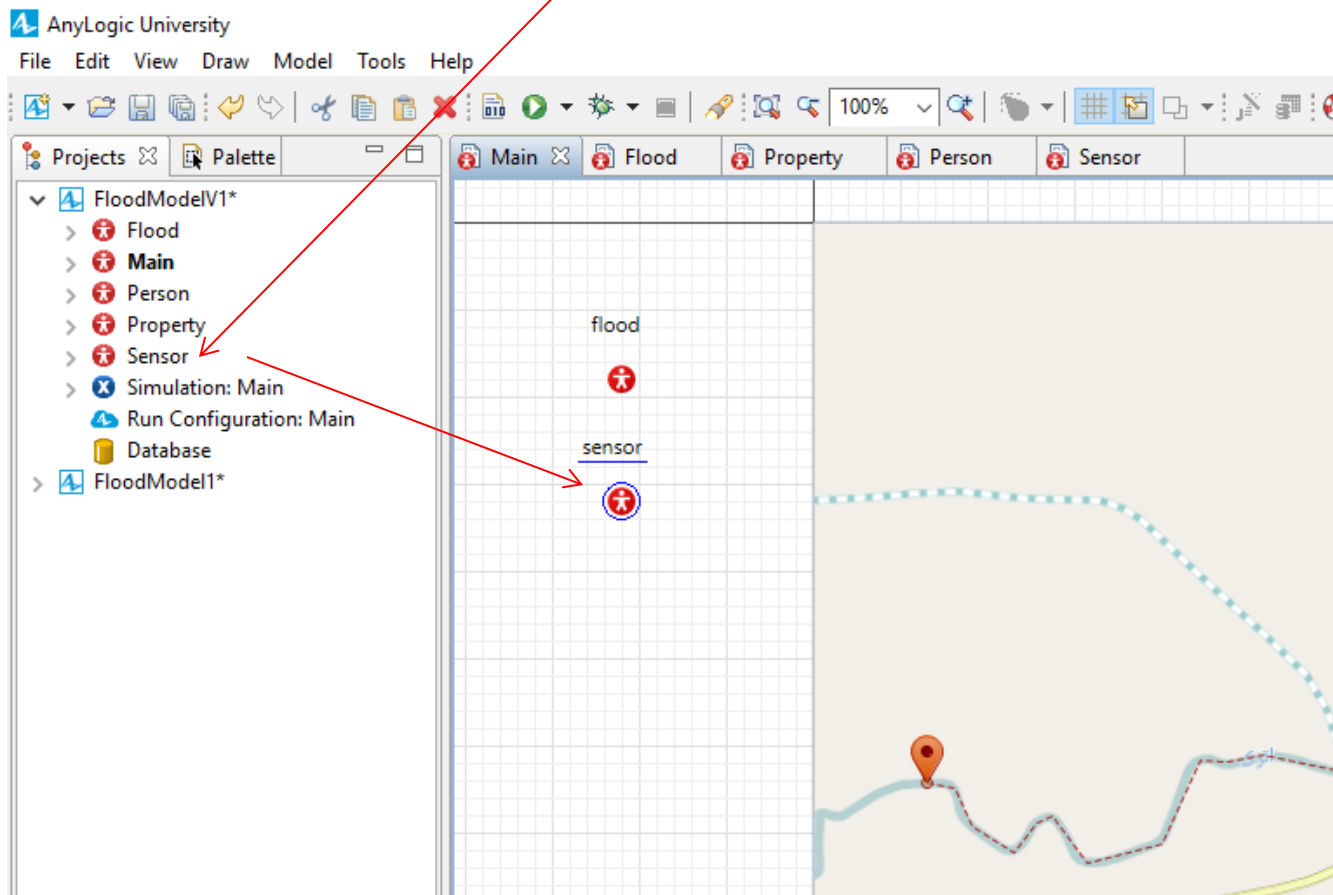


- Make sure agent population is selected.
- Look at the Property window.
- In this model we consider flood as a single agent.
- Change the speed (velocity) of the river if you like. It is 10 meters per second by default.
- Select “in the node” for Place agent(s) and choose gisPoint. This means that flood will start showing from this point

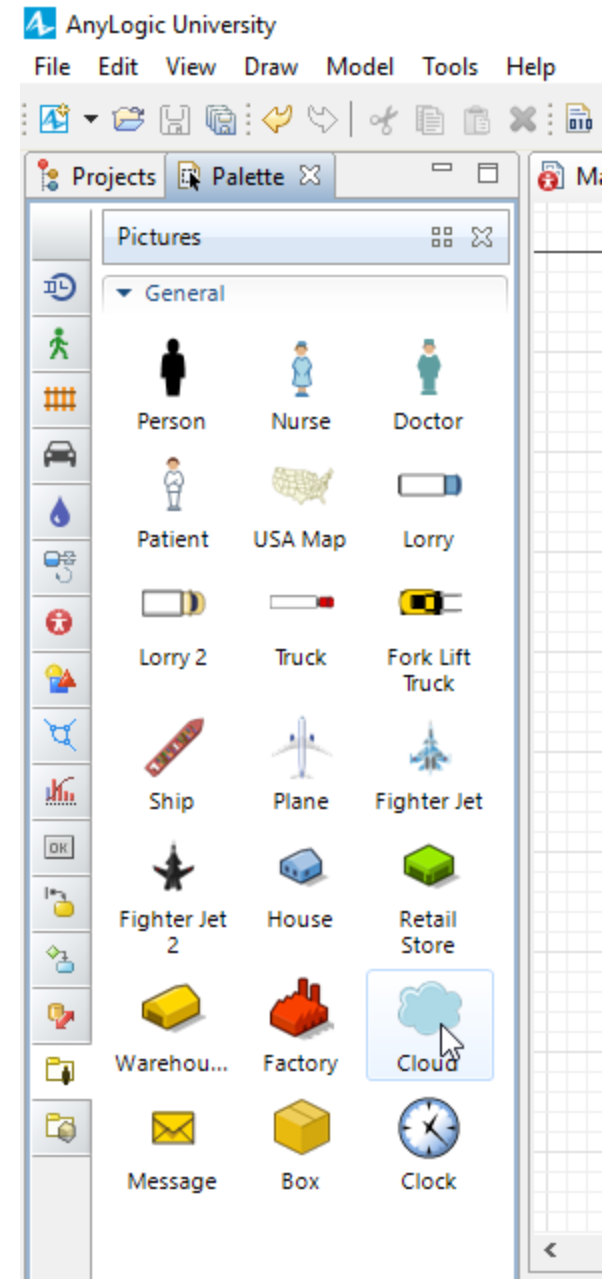


Add Sensor population

- Similar to Flood agent, drag a Sensor Agent into the Main.

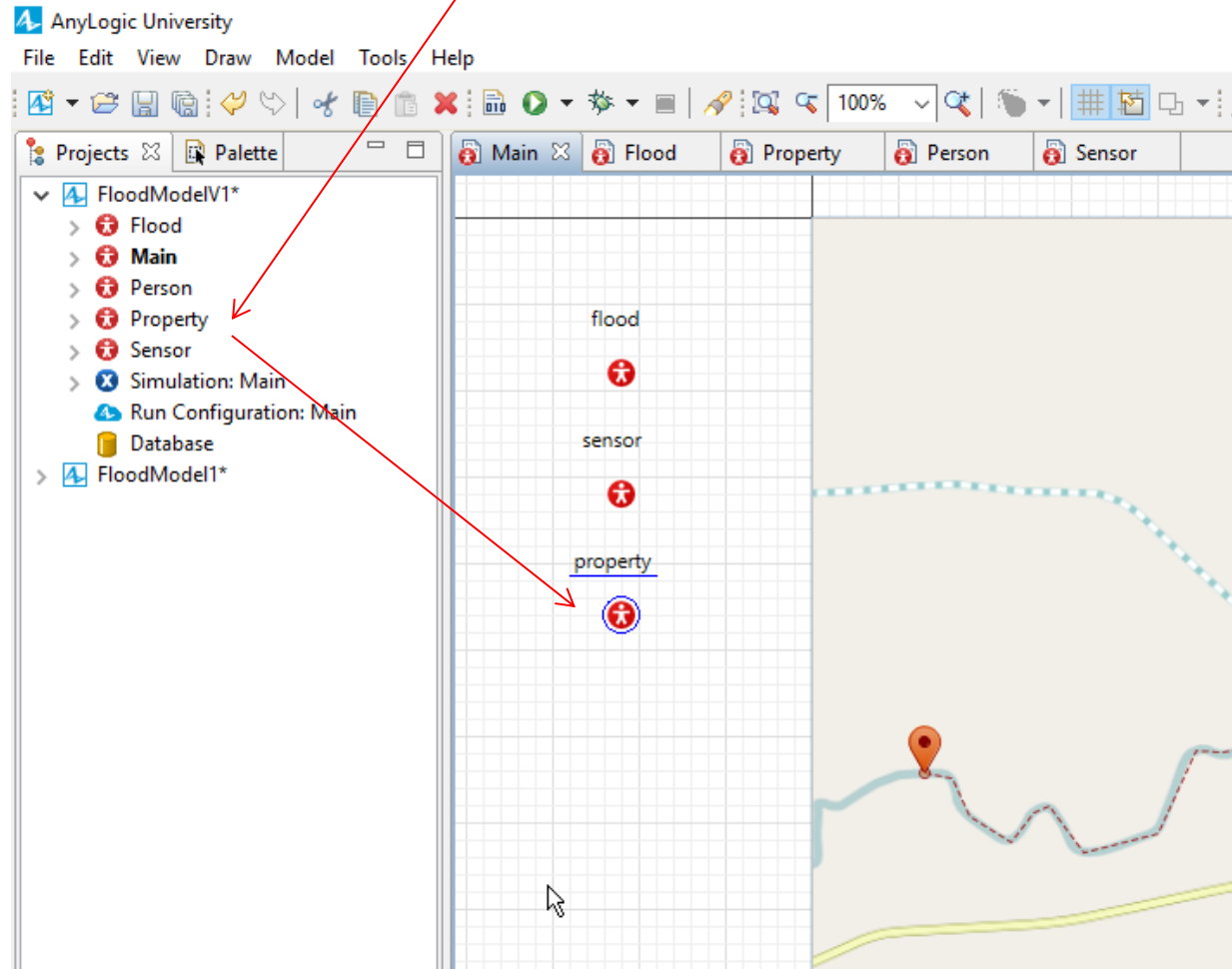


- From the Palette choose Pictures tool and then select Cloud. We use this to represent the hear of the river Flood. You can choose whatever symbol you like .



Add Property population

- Similar to Flood agent, drag a Sensor Agent into the Main.



Change Property population properties:

- Set the name to *properties*
- Choose Population of agents. Because we have many houses and buildings.
- Choose Initially empty. We will add properties programmatically.
- Leave the Place agent(s) at the agent animation

properties - Property

Name: properties Show name

Ignore

Population is: Population of agents

Initially empty

Contains a given number of agents

Loaded from database

Movement

Initial speed: 10 meters per second

Initial location

Place agent(s): at the agent animation location

in the latitude/longitude

in the node

in the first result of map search

Routing: Default

Statistics

Advanced

Model/library: FloodModelV1 [\(change...\)](#)

Visible: yes

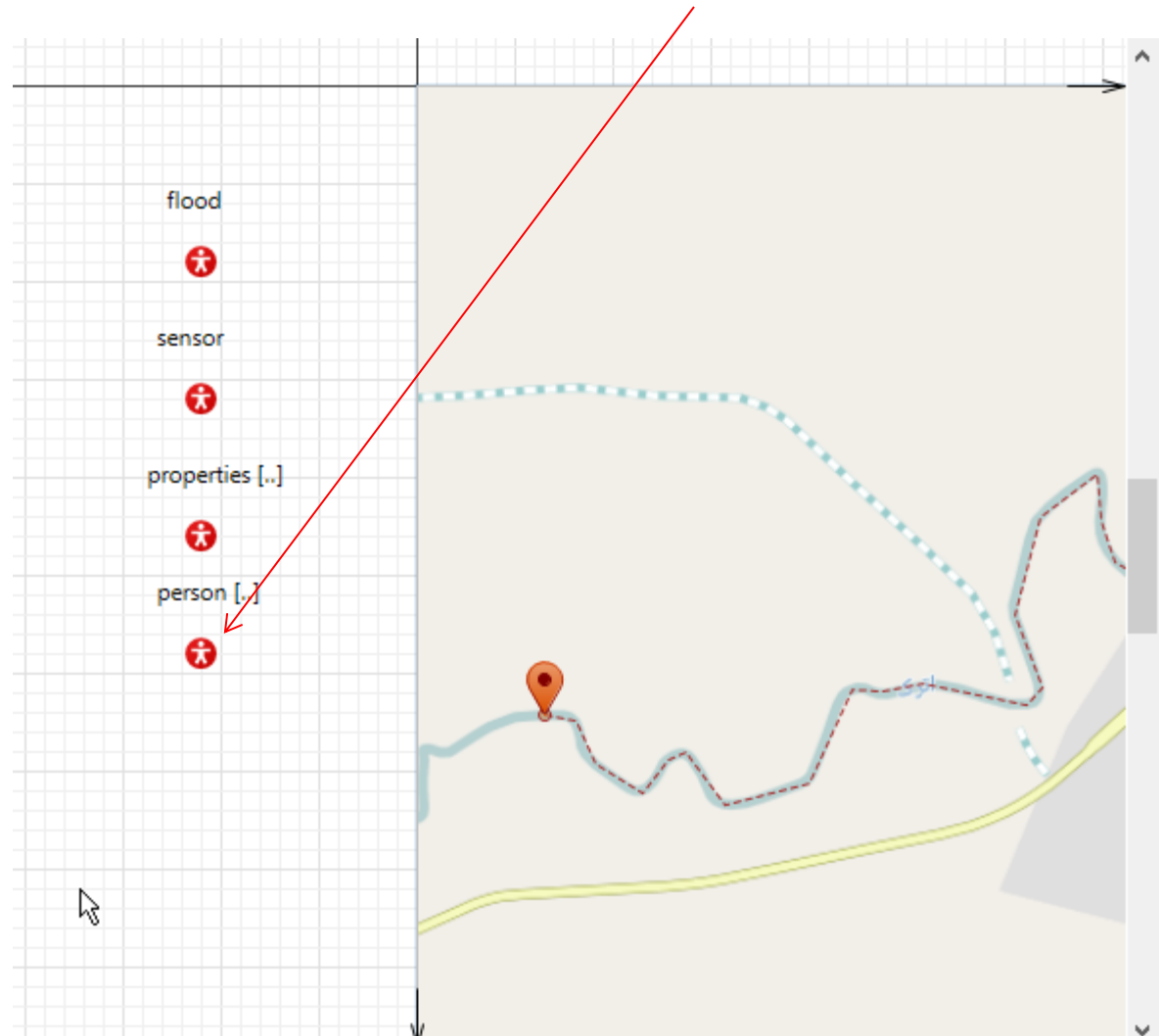
Visible on upper level

Optimize for: Access by index (ArrayList)

Add/remove operations (LinkedHashSet)

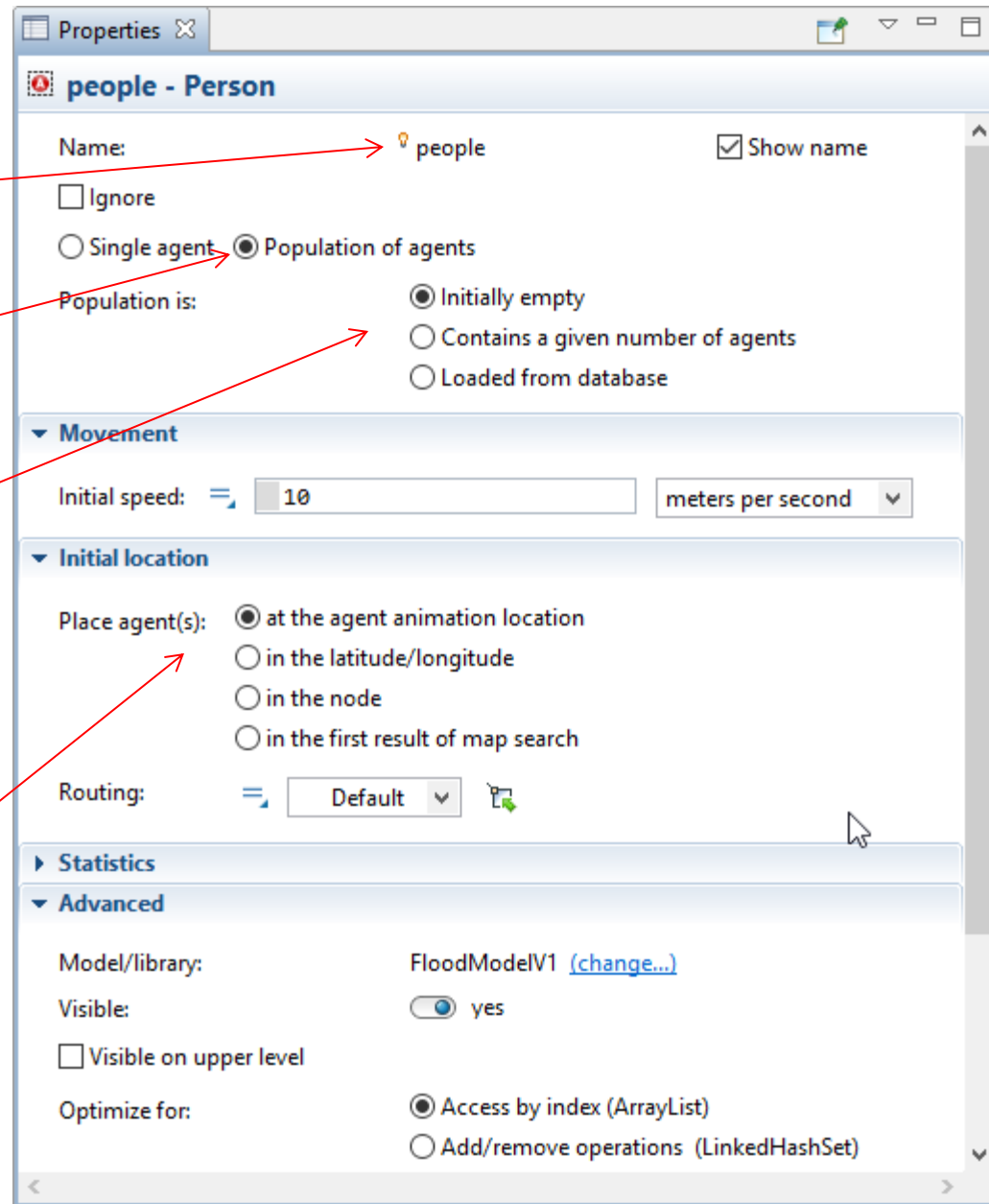
Add Person population

- Similar to Property agent, drag a Person Agent into the Main.



Change Person population properties:

- Set the name to *people*
- Choose Population of agents. Because we have many people.
- Choose Initially empty. We will add people programmatically.
- Leave the Place agent(s) at the agent animation



- Save your project.
- In the next lesson we add agent population for properties and people and define the behavior and movements different agents.