



HAL
open science

Graph theory applied to agroforestry system co-design

Laetitia Lemière, Marc Jaeger, Gérard Subsol, Marie Gosme

► **To cite this version:**

Laetitia Lemière, Marc Jaeger, Gérard Subsol, Marie Gosme. Graph theory applied to agroforestry system co-design. 5th World Congress on Agroforestry, Jul 2022, Québec, Canada. hal-03739687

HAL Id: hal-03739687

<https://hal.inrae.fr/hal-03739687v1>

Submitted on 28 Jul 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Graph theory applied to agroforestry system co-design

Lemière Laëticia^{1,2}, Jaeger Marc², Subsol Gérard³, Gosme Marie¹

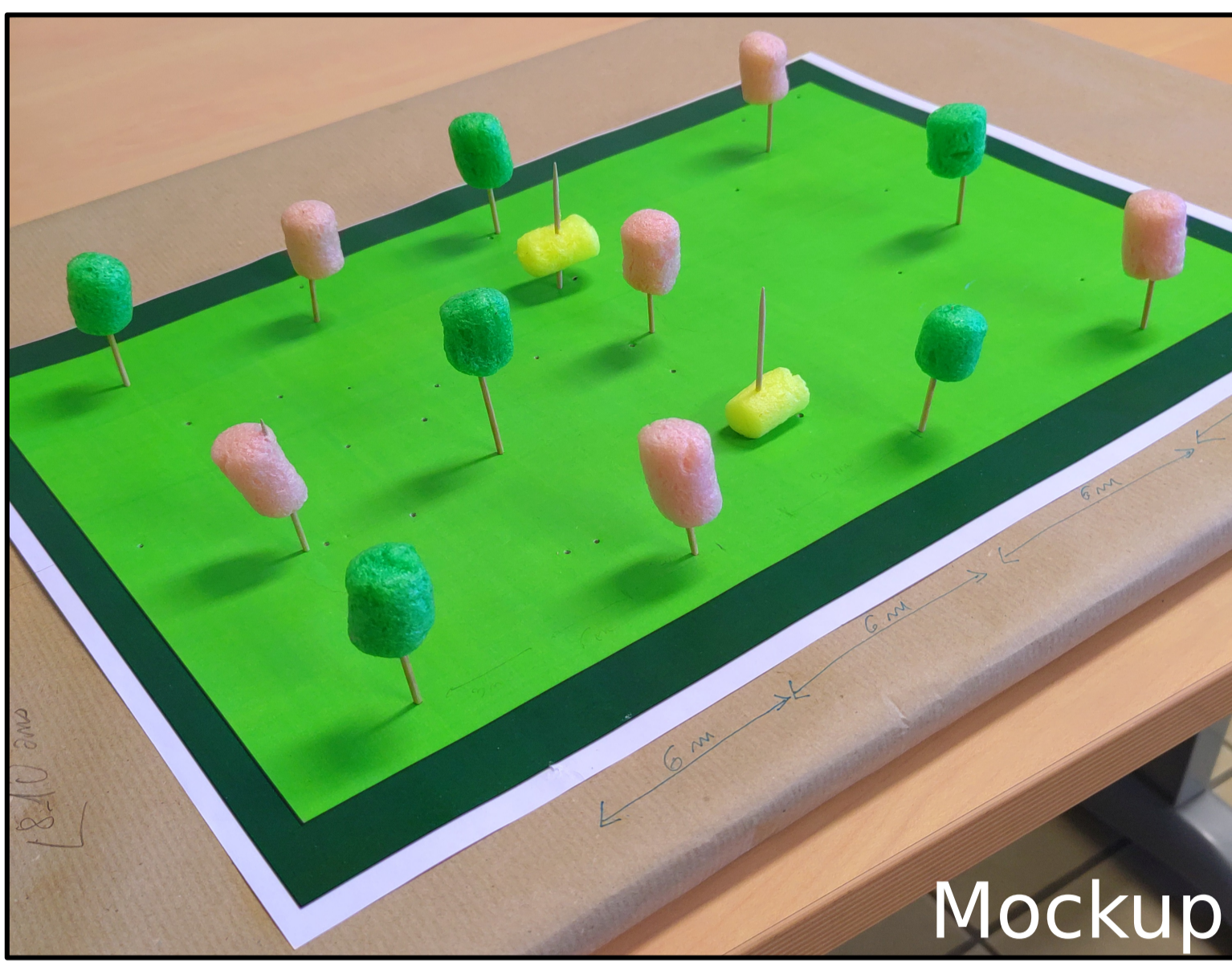
¹ABSys, Univ Montpellier, CIHEAM-IAMM, CIRAD, INRAE, Institut Agro, Montpellier, France

²CIRAD, UMR AMAP, F-34398 Montpellier, France

AMAP, Univ Montpellier, CIRAD, CNRS, INRAE, IRD, Montpellier, France

³Research-Team ICAR, LIRMM, Univ Montpellier, CNRS, Montpellier, France

contact : laetitia.lemiere@inrae.fr



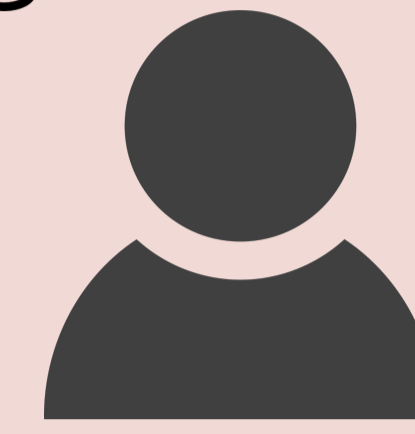
Mockup



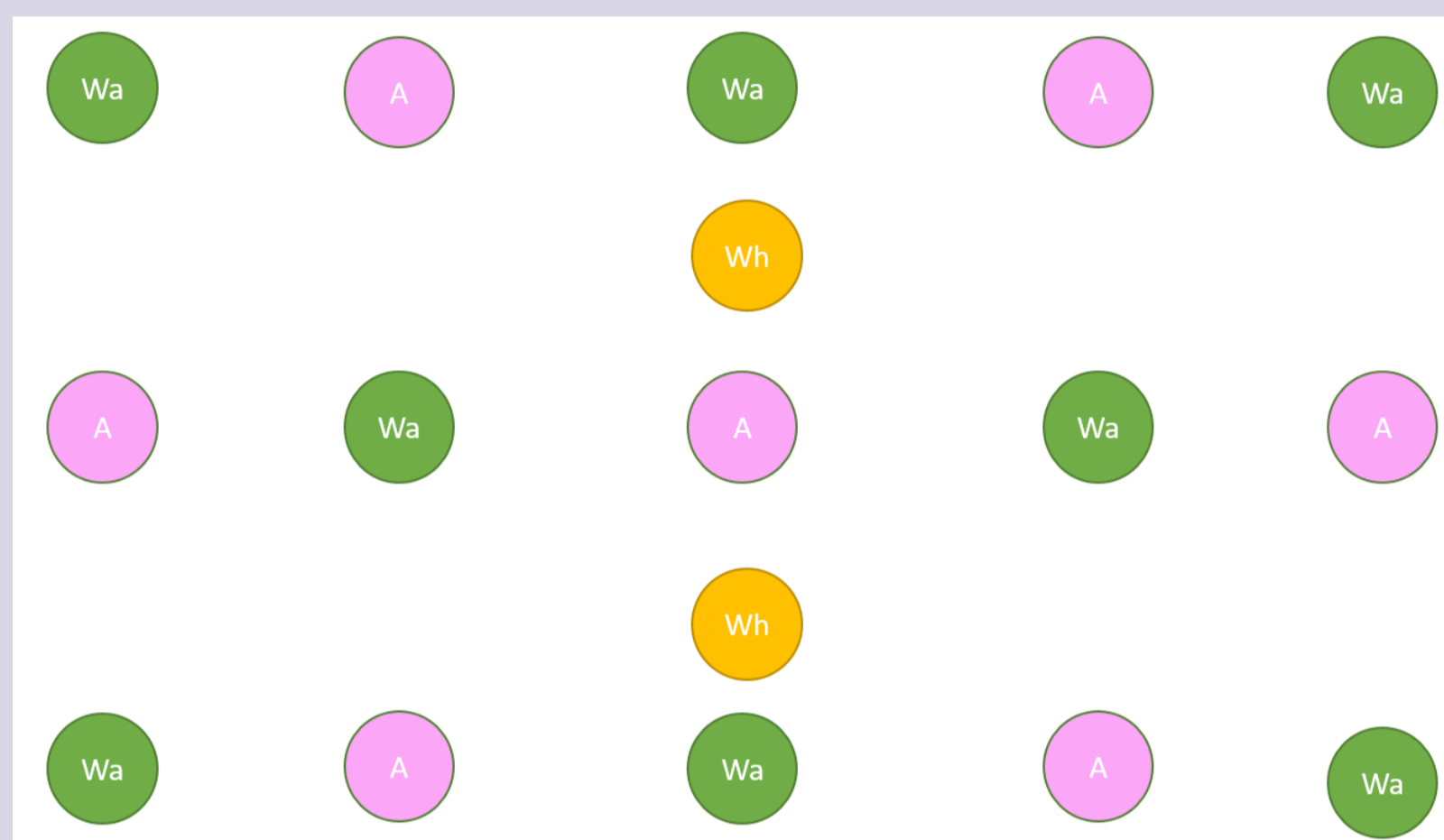
Traditional way



(Space and time) Designs are not easy to share



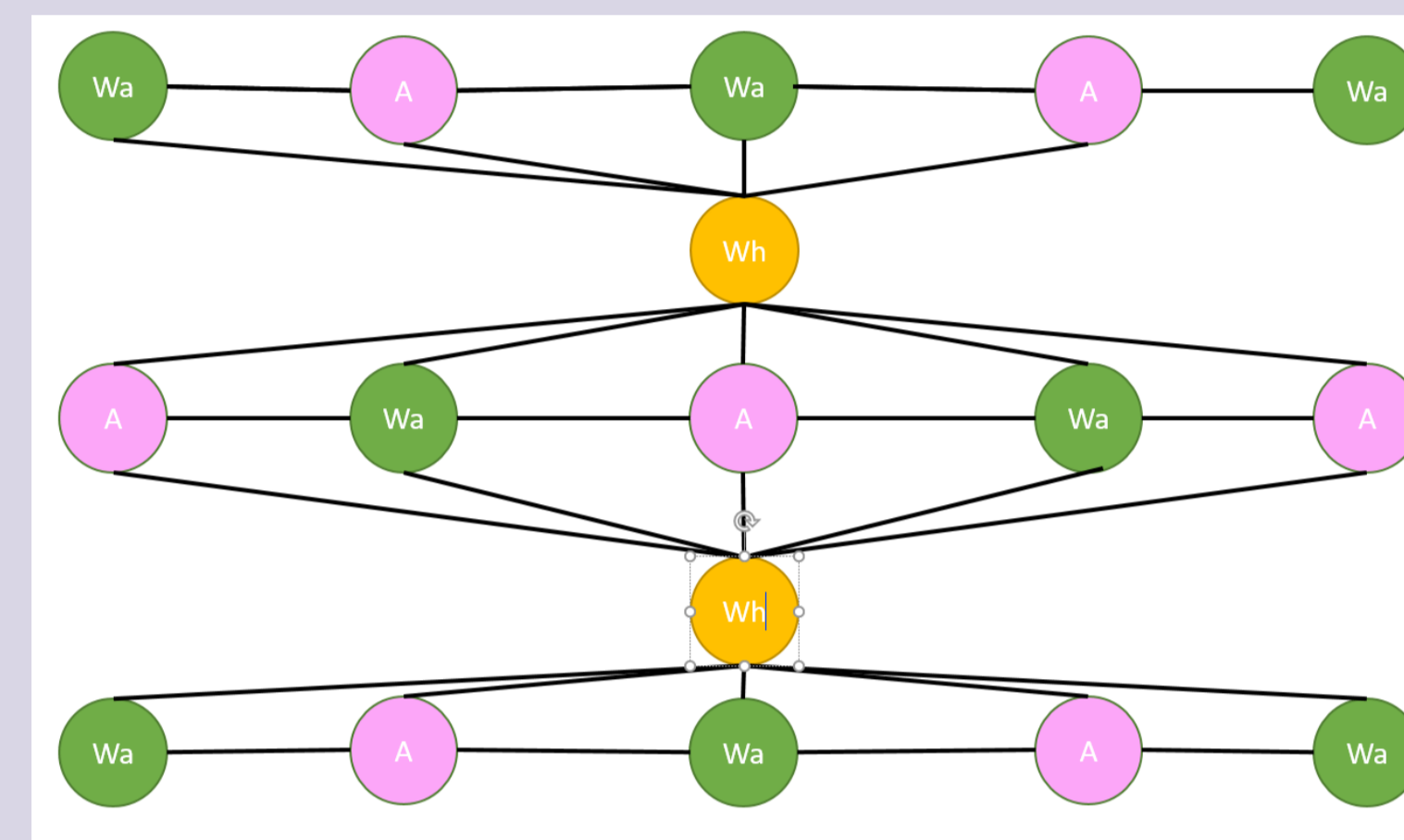
Our method



Processed digital twin of the mockup

Each element is transformed into a node

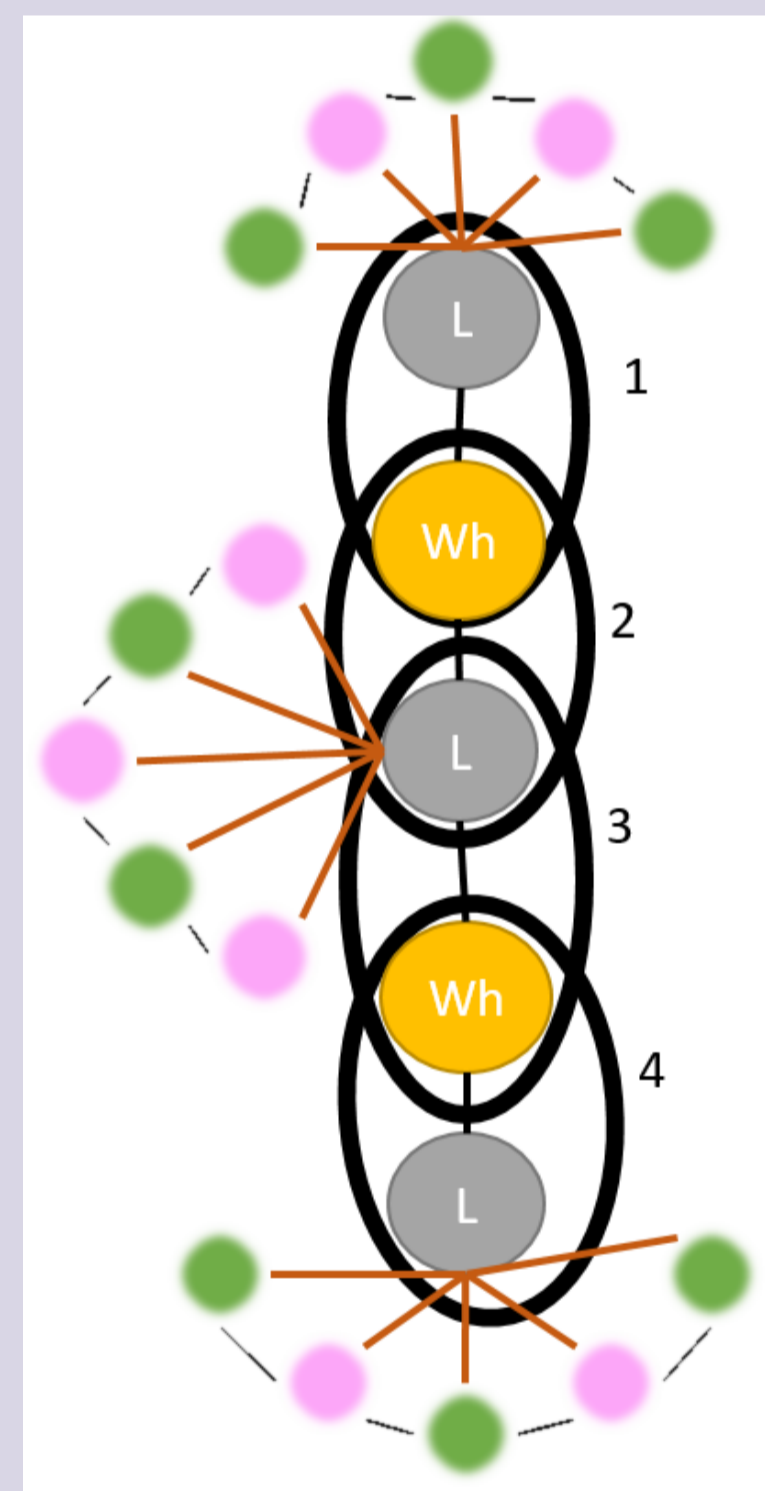
- = Apple tree
- = Walnut
- = Wheat



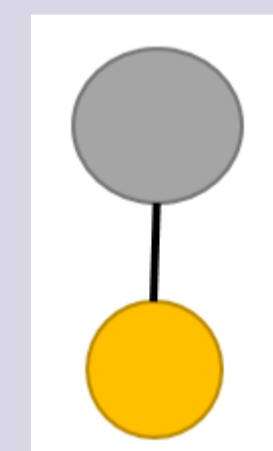
Digital twin is translated into a graph
2 elements are neighbors -> an edge



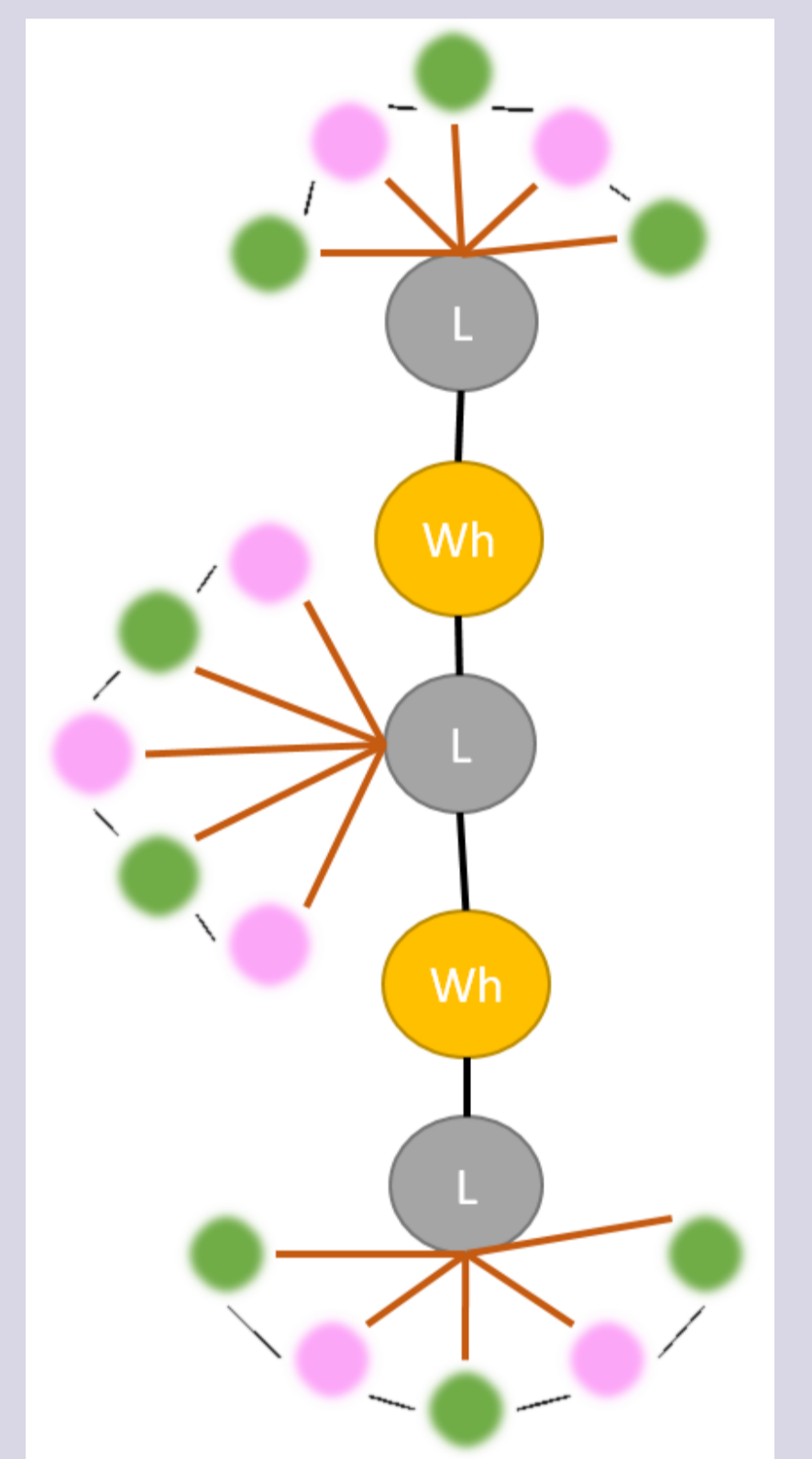
Visualization of the agroforestry system with ecosystem services



Search of known patterns
1 pattern = structure supporting ecosystem services



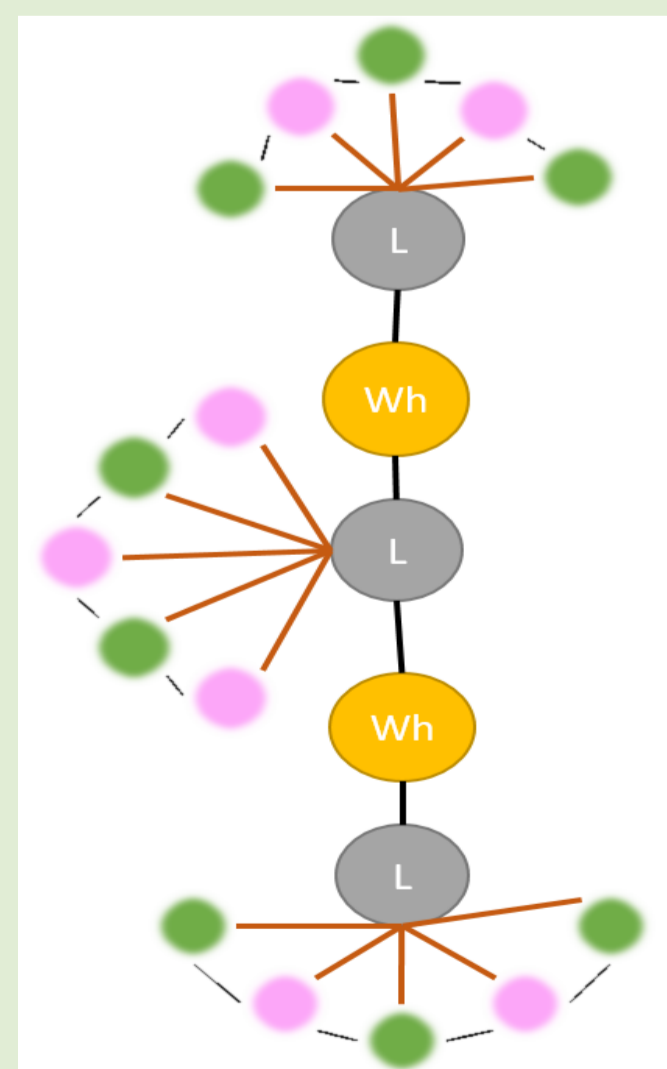
= limiting water stress by tree shadow



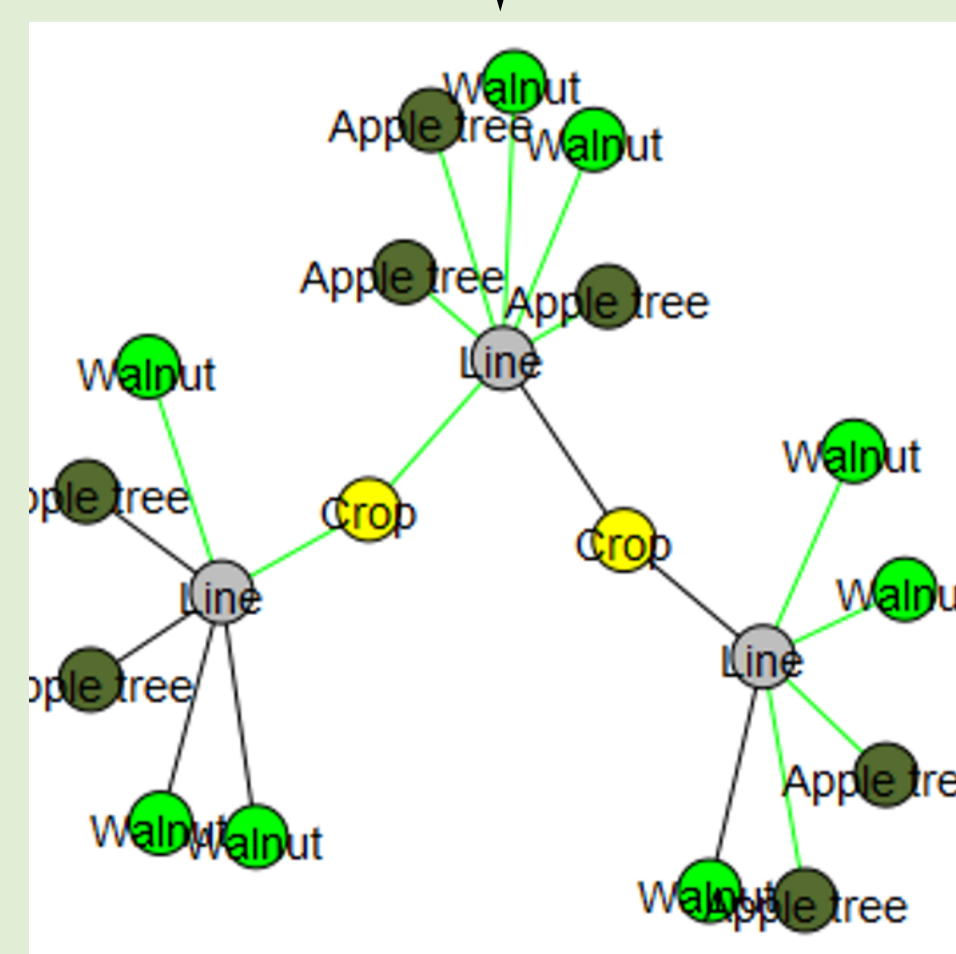
Hierarchical graph
Higher level elements are identified
● = vegetal cover

Results and discussion

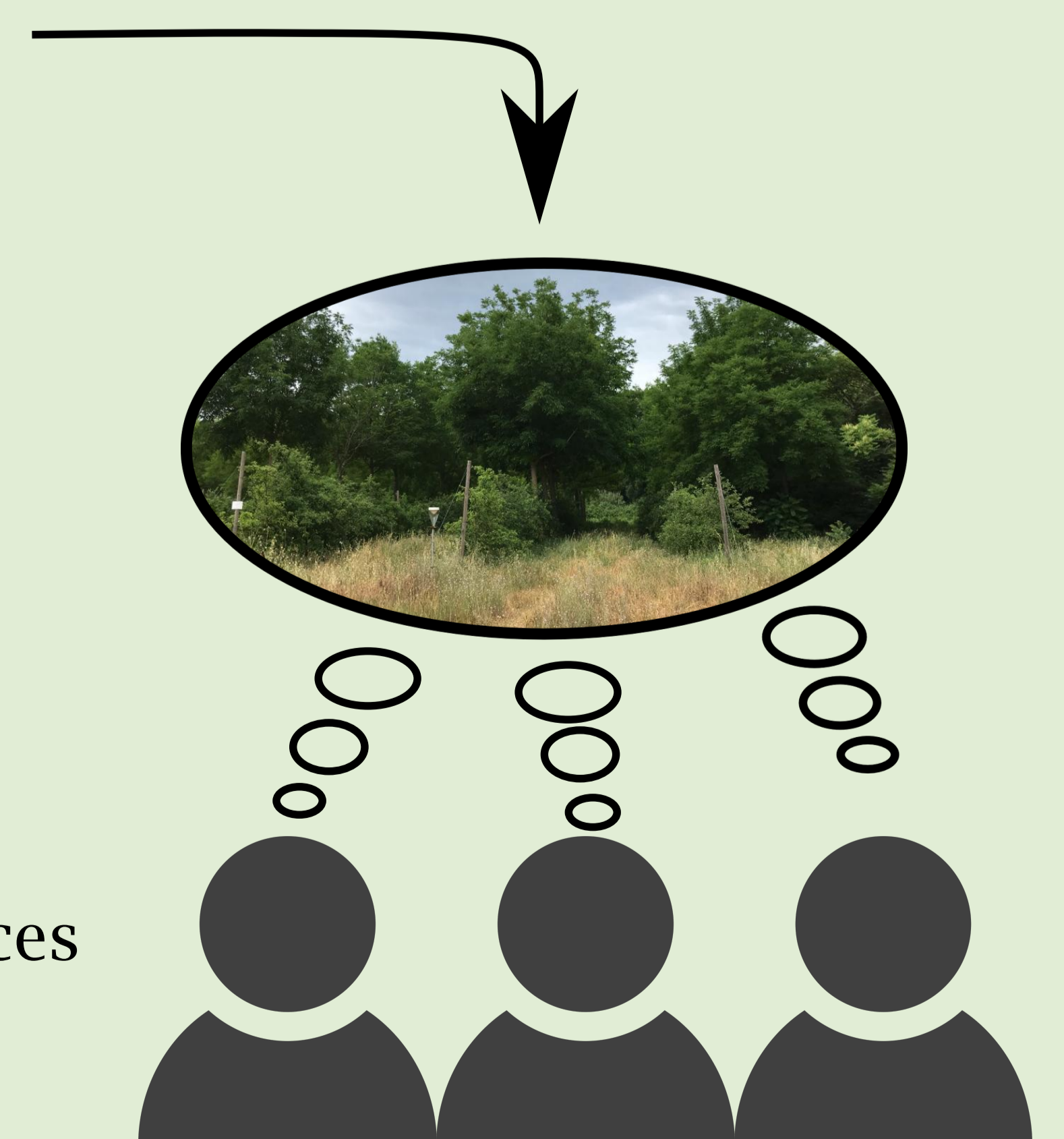
A novel way to describe agroforestry systems based on graphs



To compare agroforestry systems



To model temporal evolution of ecosystem services



To share a more precise common view

Better knowledge of the system