Multi-platform Training Sessions to Teach Agent-Based Simulation

MISS-ABMS
2-week Summer Schools
organized every year since 2011 in Montpellier (France)

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Multi-platform International Summer School on Agent-Based Modelling & Simulation for Renewable Resources Management

3 platforms → GAMA …modeling made easy… https://code.google.com/p/gama-platform/

https://ccl.northwestern.edu/netlogo/

NetLogo

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Multi-platform **I**nternational **S**ummer **S**chool on **A**gent-**B**ased **M**odelling & **S**imulation for Renewable Resources Management

- ❑ Principles, methods and technics of the various stages of ABMS (design, implementation and exploration)

- ❑ Focus on a participatory use of models and simulation (in relation to the **Companion Modelling** approach that was initiated in Montpellier in the 90's)

- ❑ Participants are requested to organize themselves into small groups of 2-4 to develop prototypes: the design stage can only be collaborative

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Group work: setup during 1st week…

Day 1	Day 2	Day 3	Day 4	Day 5
Welcome Session	Conceptual Modelling : theory, concepts and practice	Conceptual model Specifying the processes with UML	*PPMs* Groups	Coding Practice on 1 platform
Theory of modelling and simulation in the field of socio-ecosystems	*Benchmark Model* Conceptual Modelling	*Benchmark Model* UML sequence and activity diagram	Models calibration and analysis	
ReHab Ice-breaking role-playing game	Conceptual model Designing the structure with UML	*Benchmark Model* For each platform Metamodel of the scheduler Demo : implementation of dynamics	*Benchmark Model* For each platform Demo : monitoring and visualisation	
			For each platform Demo of platform specifities	
Introduction to multi-agent systems and agent-based simulation	*Benchmark Model* UML Class diagram	*Participants' Prototype Models (PPMs)* Presentation and discussion	General discussion on platforms Choice of a platform	*Participants' Prototype Models (PPMs)* Story and conceptual model
Uses of Agent-Based Models for socio-ecosystems : a panorama	*Benchmark Model* For each platform Metamodel of the platform Demo : implementation of structure and initialisation		Coding Practice on 1 platform	Presentation of PPMs

Plenary session
Tools demo
Plenary lecture (methodology)
Individual exercise
Group work

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Group work: main activity during 2nd week

Day 6	Day 7	Day 8	Day 9	Day 10
Case Study : a project with a conceptual model	Case Study : a project with CORMAS platform	Case Study : a project with GAMA platform	Case Study : Wat-A-Game + a project with Netlogo platform	Preparation of PPMs presentation & demo
Participants' Prototype Models (PPMs) Class diagram, structure and intialisation	*Participants' Prototype Models* (PPMs) Sequence diagram and global dynamics	*Participants' Prototype Models* (PPMs) Activity diagrams and agents behaviours	*Participants' Prototype Models* (PPMs) Indicators, visualisation and analysis	Presentation and demo of PPMs
				Final debriefing
Documentation of ABMs		Validation of models		
Participants' Prototype Models (PPMs) Class diagram, structure and intialisation	*Participants' Prototype Models (PPMs)* Sequence diagram and global dynamics	General discussion on validation *Participants' Prototype Models (PPMs)* Activity diagrams and agents behaviours	*Participants' Prototype Models (PPMs)* Indicators, visualisation and analysis	
PPMs - static Presentation to another group	*PPMs - global dynamics* Presentation to another group	*PPMs - agents behaviours* Presentation to another group	*PPMs - visualisation* Presentation to another group	

Summer School Diner

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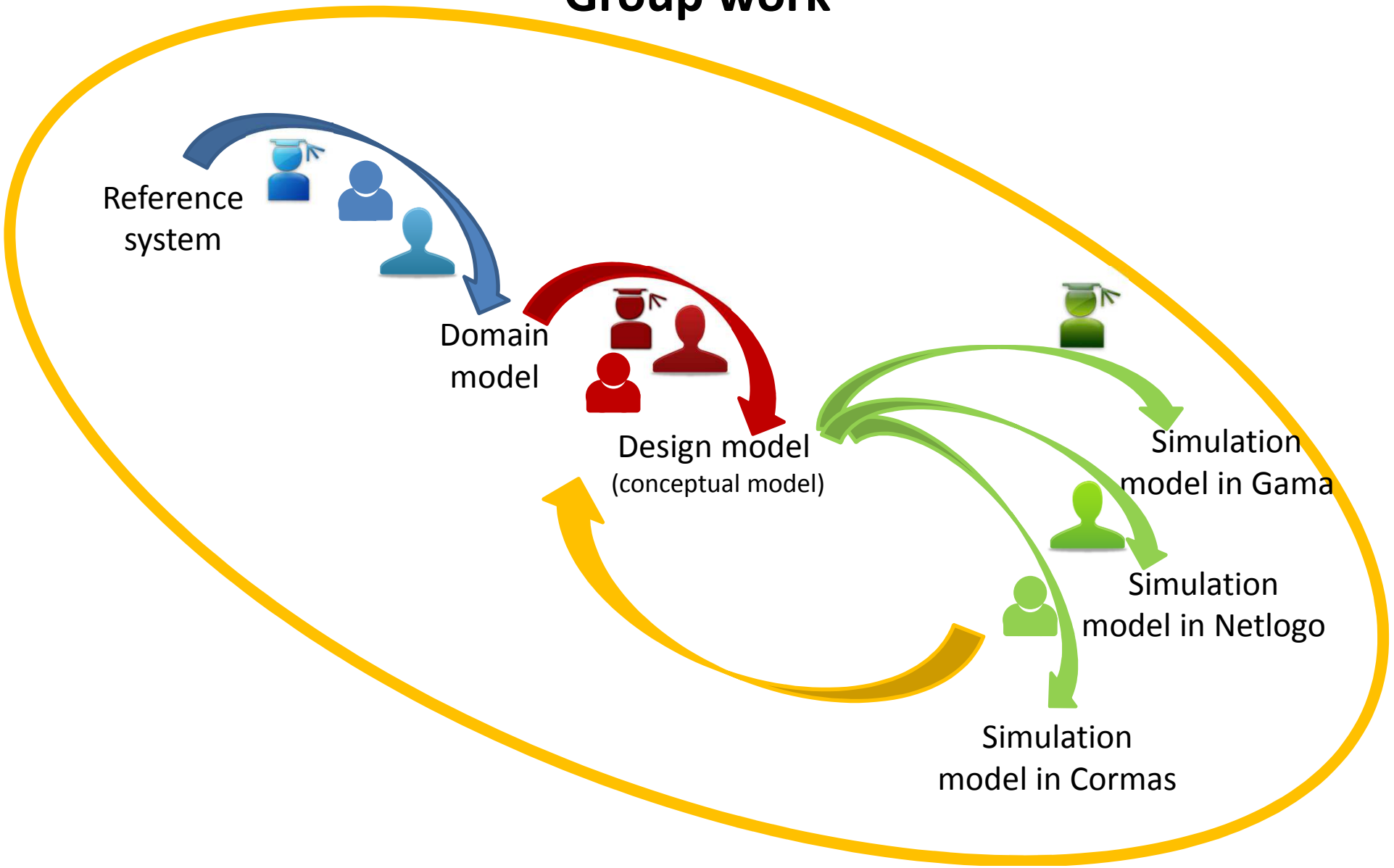
Group work



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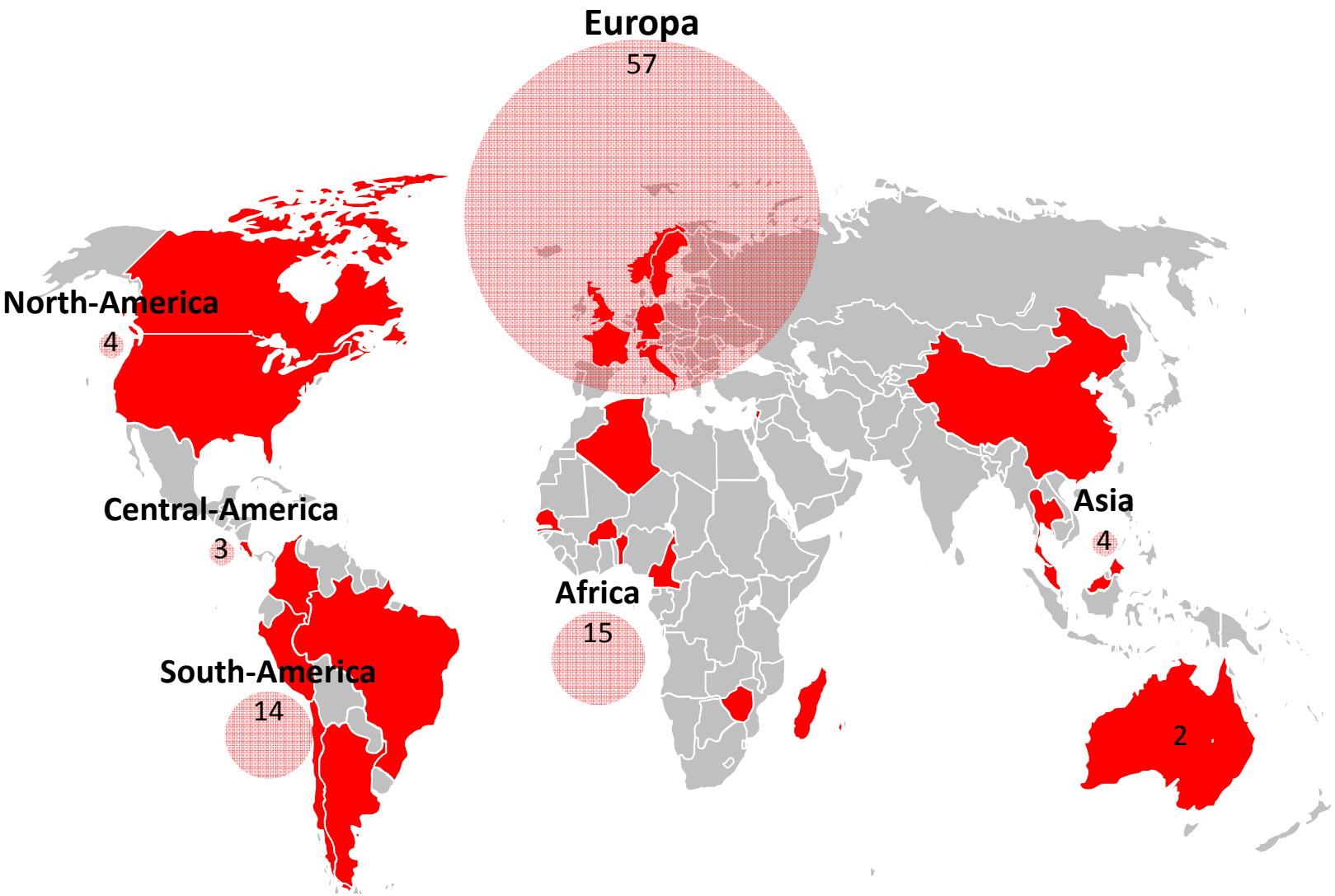
Setting-up a worldwide network



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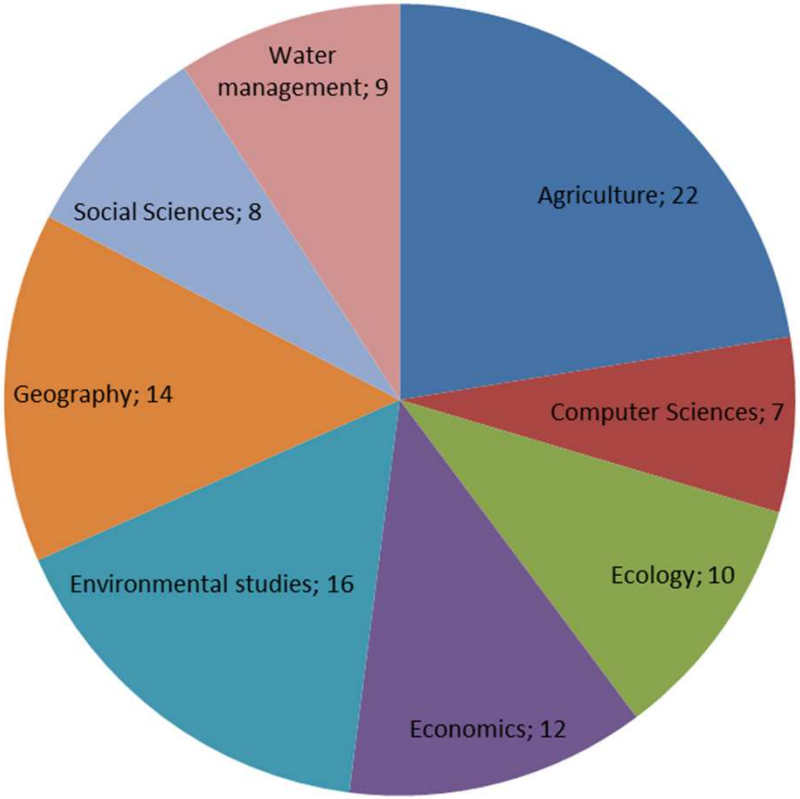
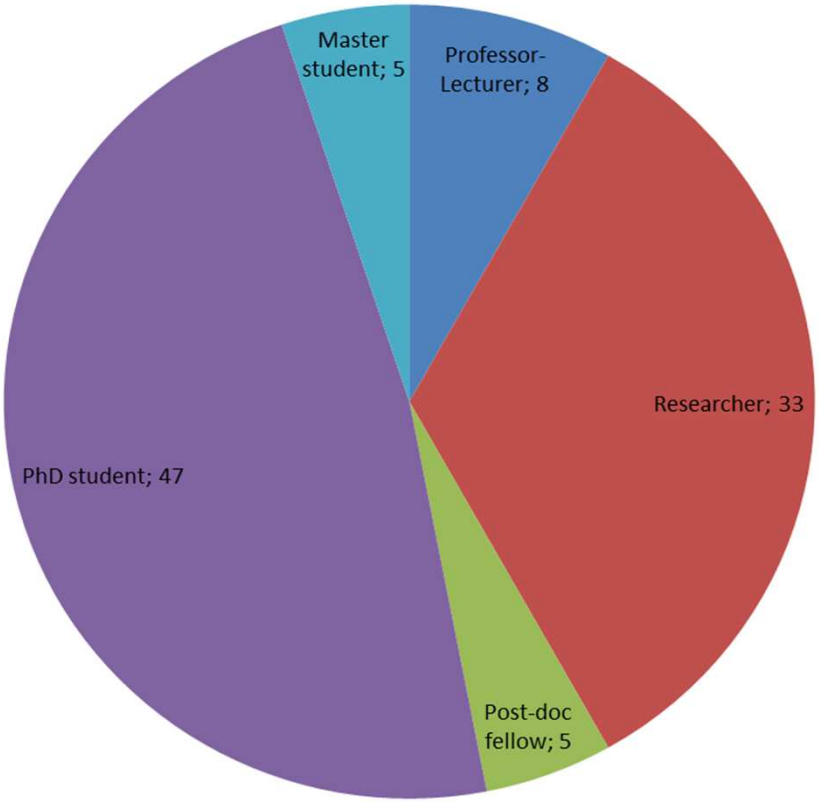
Diversity of participants



Disciplines



Positions

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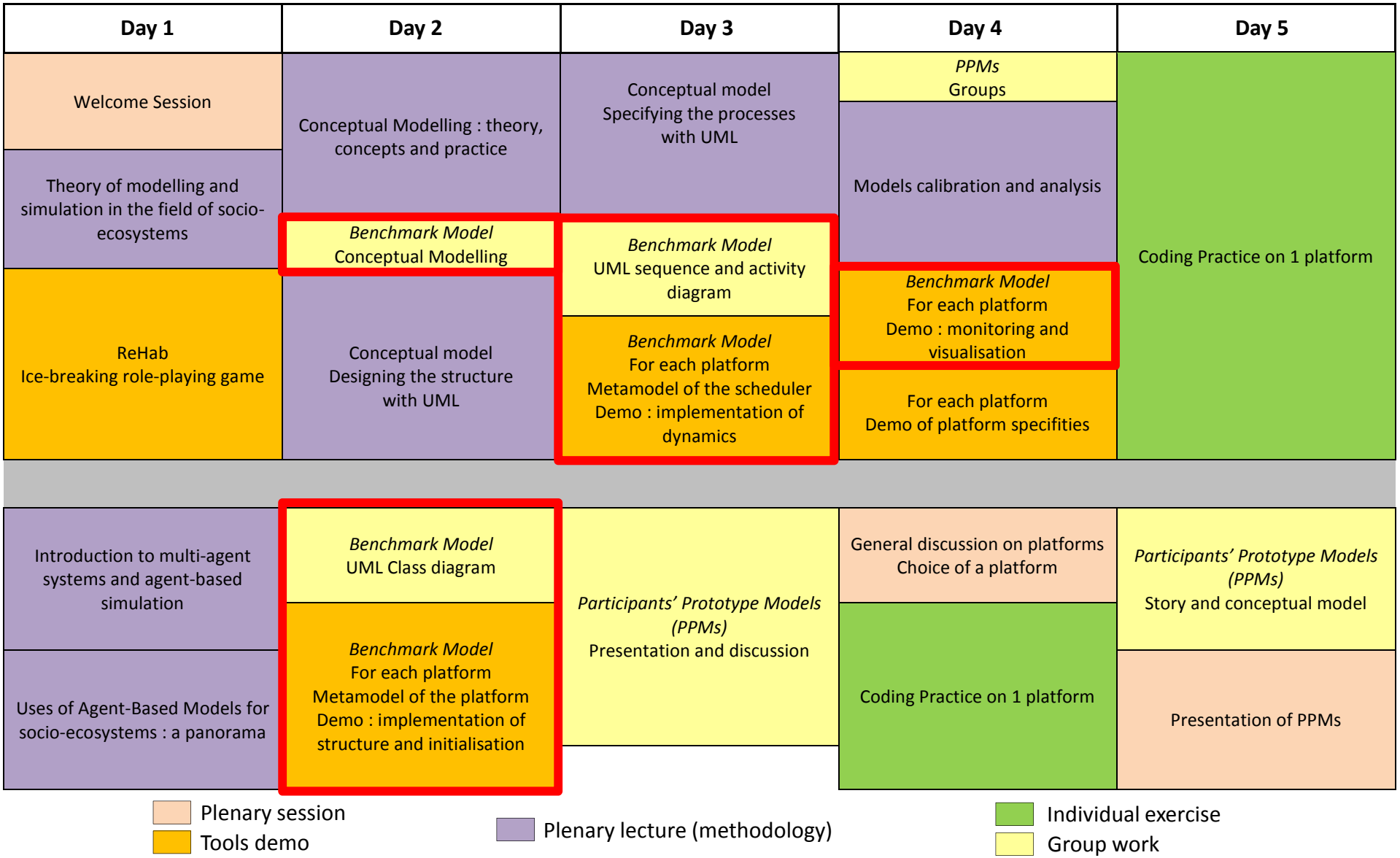
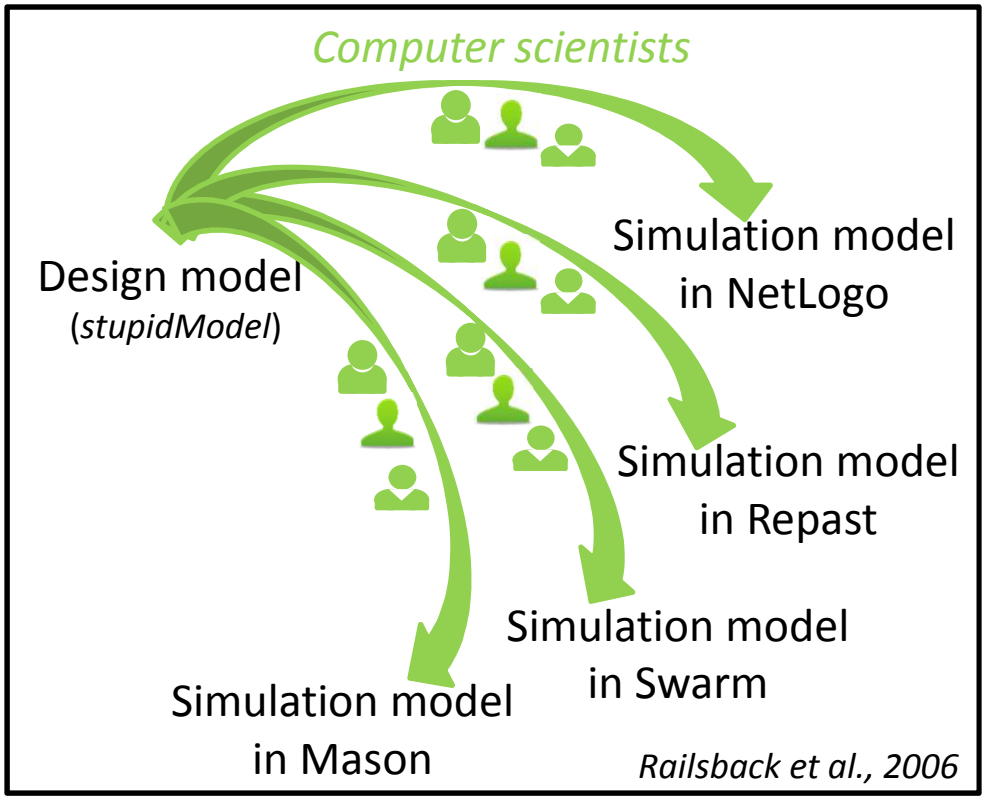
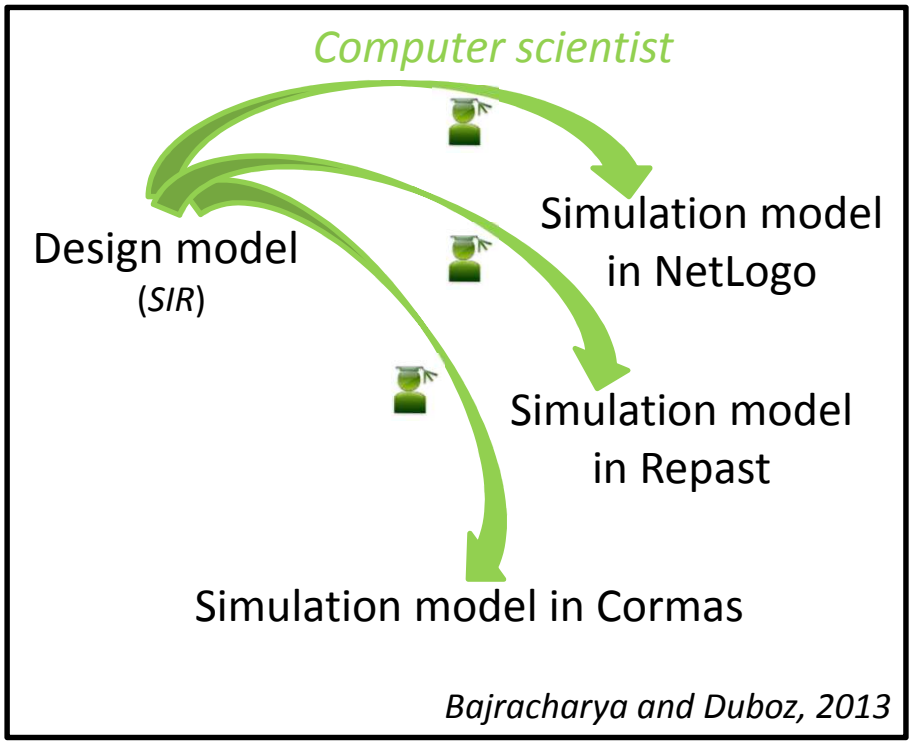
Triplication of a benchmark model



Implementing the same benchmark model with various ABM platforms





When the implementations are performed by the same computer scientists, there is a bias due to the unequal command of the different platforms

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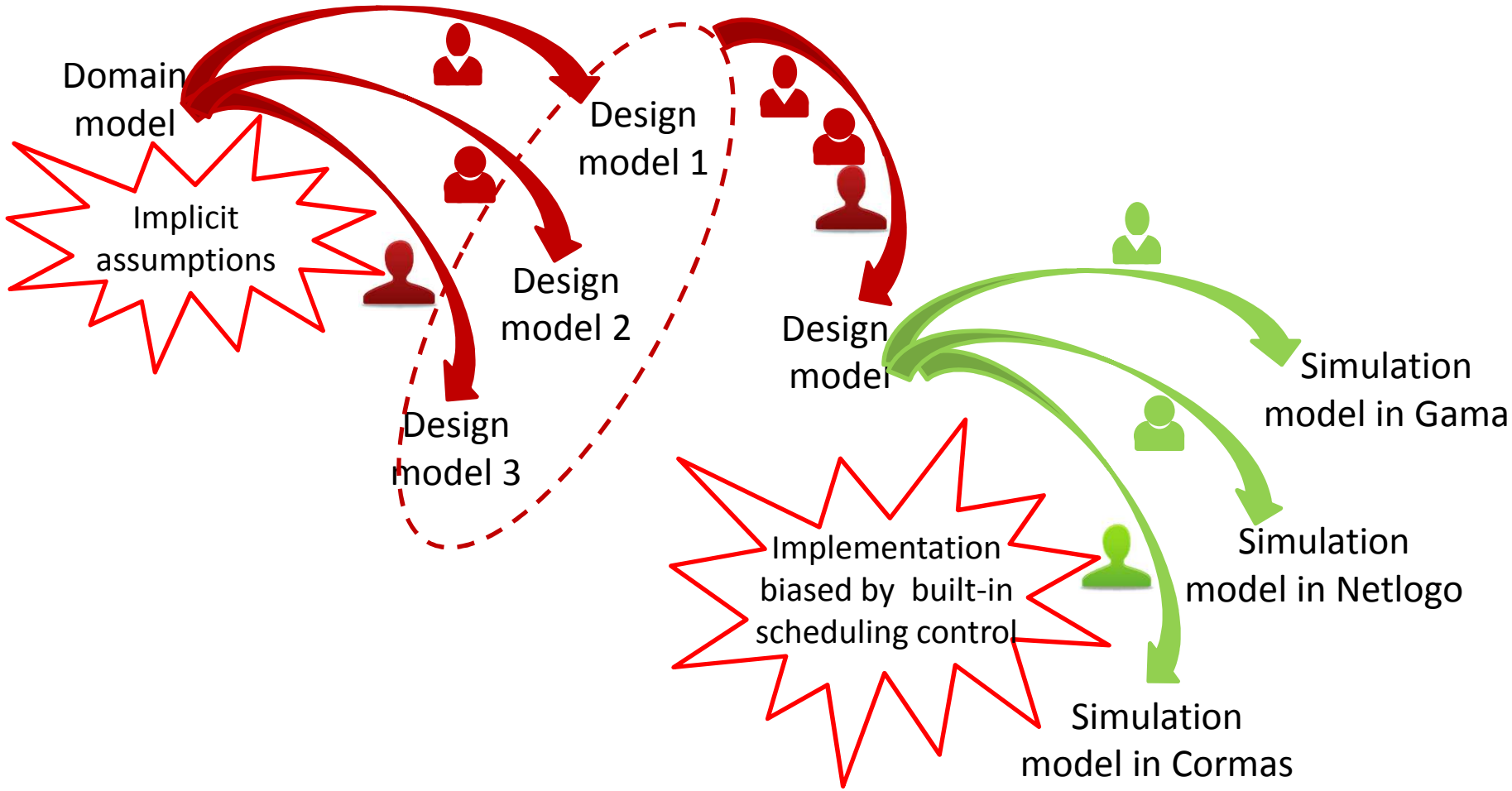
Triplication of a benchmark model by experts of the 3 platforms



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Benchmark model: verbal description

- A landscape displays a random pattern with half forested plots and half cleared plots. The area represents 900 Ha of a fire-prone monospecific open forest that is divided in plots of 1 Ha. When a fire breaks out, it spreads swiftly around the landscape by setting ablaze all neighboring forested plots.
- A voluntary forest fire-fighting brigade made of 10 firefighters is monitoring the forest. Each firefighter patrols the forest by moving randomly from one plot to a surrounding plot. When detecting a burning plot around its location, a firefighter goes to the fire site to extinguish it.
- In a first scenario, firefighters act independently: they have no mean to know where the other fighters are located and what they are currently doing.
- In a second scenario, the location and the status (fighting a fire or patrolling) of each firefighter are known to all. When a firefighter does not detect any fire around his/her own location, he/she moves towards the closest fire fought by one the other firefighters if any, else he/she continues patrolling
- Compare the two scenarios when initially a fire breaks out in a forested plot randomly picked.

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elements
attributes
data

processes
relationships

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Benchmark model: differences in design

- Implicit assumptions about time
  - ✓ Speed of fire spreading relative to duration of firefighters' activities

- Implicit assumptions about space
  - ✓ Neighborhood: 4-6-8 ???

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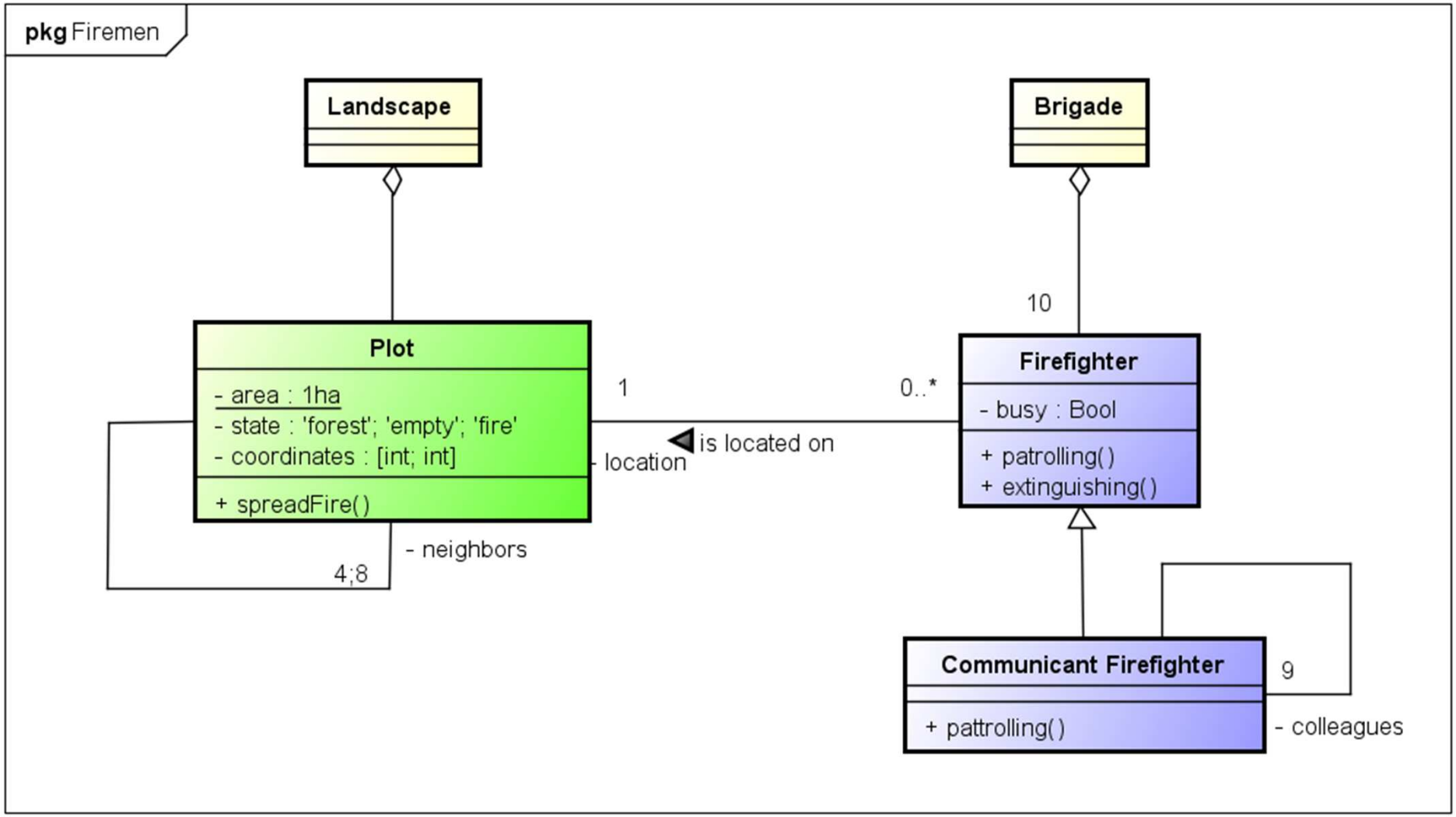
Benchmark model: a unified design (UML)



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Benchmark model: simulation outputs

- The importance of observation
  - ✓ Running simulations to figure out if the model is right (verifying that what is exhibited corresponds to what was supposed to be coded)
  - ✓ Running simulations to identify meaningful indicators
    - Time to extinguish the fire
    - Size of the remaining forest

- Mastering the dimensions of stochasticity
  - ✓ Specifying an initial landscape ?

- Comparison of the 3 implementations still to be carefully conducted

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Take-home messages

- With their unexpected behavior, trainees are gifted for tracking down highly unlikely bugs… Training sessions help enhancing the robustness of platforms!

- Trainers are also learning!
  - ✓ new ideas for improving the platforms from deeper look into other platforms,
  - ✓ detection and specification of agent-based modeling primitives (AMPs)* usable in the various platforms

- 2016 edition: http://www.agropolis.org/miss-abms/

**Bell et al, 2015*