



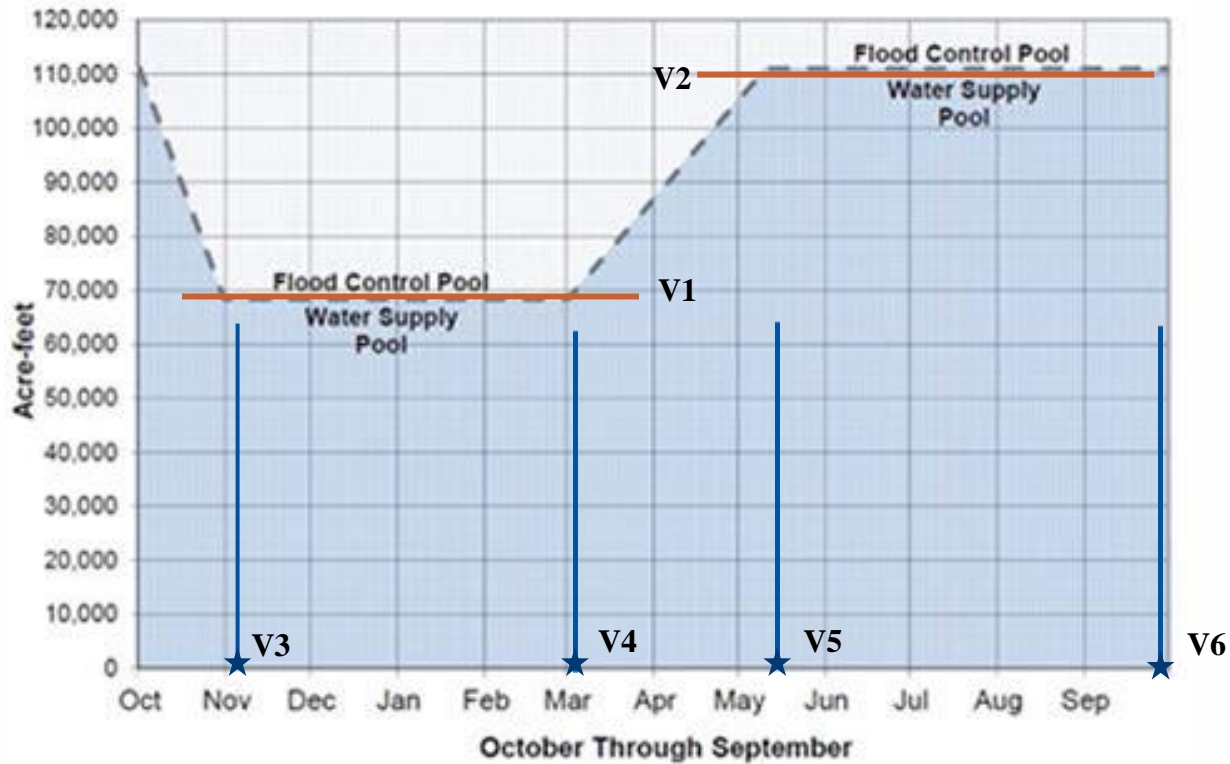
Center for Advanced Decision Support for  
Water and Environmental Systems (CADSWES)

UNIVERSITY OF COLORADO **BOULDER**

# **Borg-RiverWare Multi-objective simulation-based optimization**

**2023 RiverWare User Group Meeting  
Edie Zagona and Patrick Lynn**

## Example: find the best flood control policy



Problem: Find the best set of values of these 5 variables

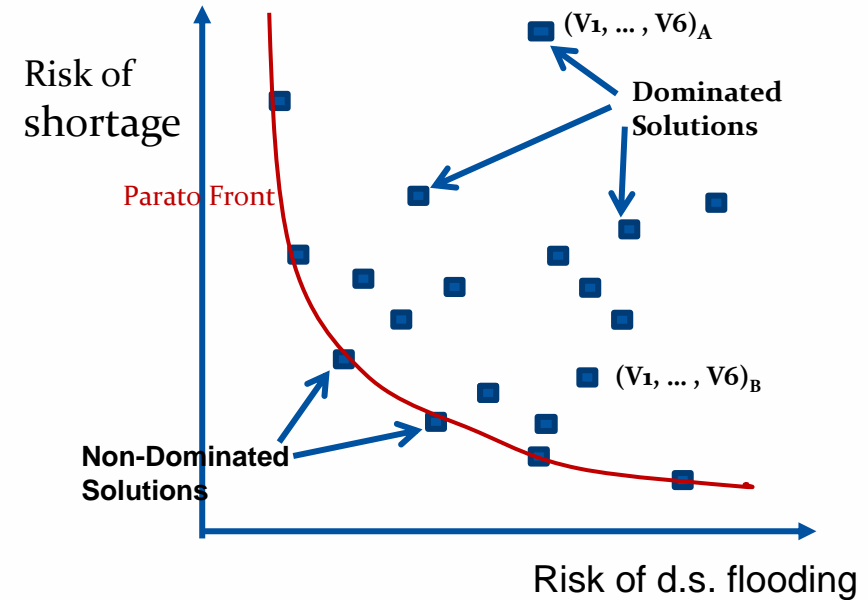
Criteria (objectives):

Minimize risk of flooding downstream

Minimize risk of water supply shortage

How to solve: run many simulations, e.g. POR, with combinations of values of the variables.

Compute the values of the objectives for each.



1. Eliminate dominated solutions
2. Identify non-dominated solutions to consider for the policy
3. Decision-making: what tradeoff to accept between the objectives?

**Automate by using MOEA**

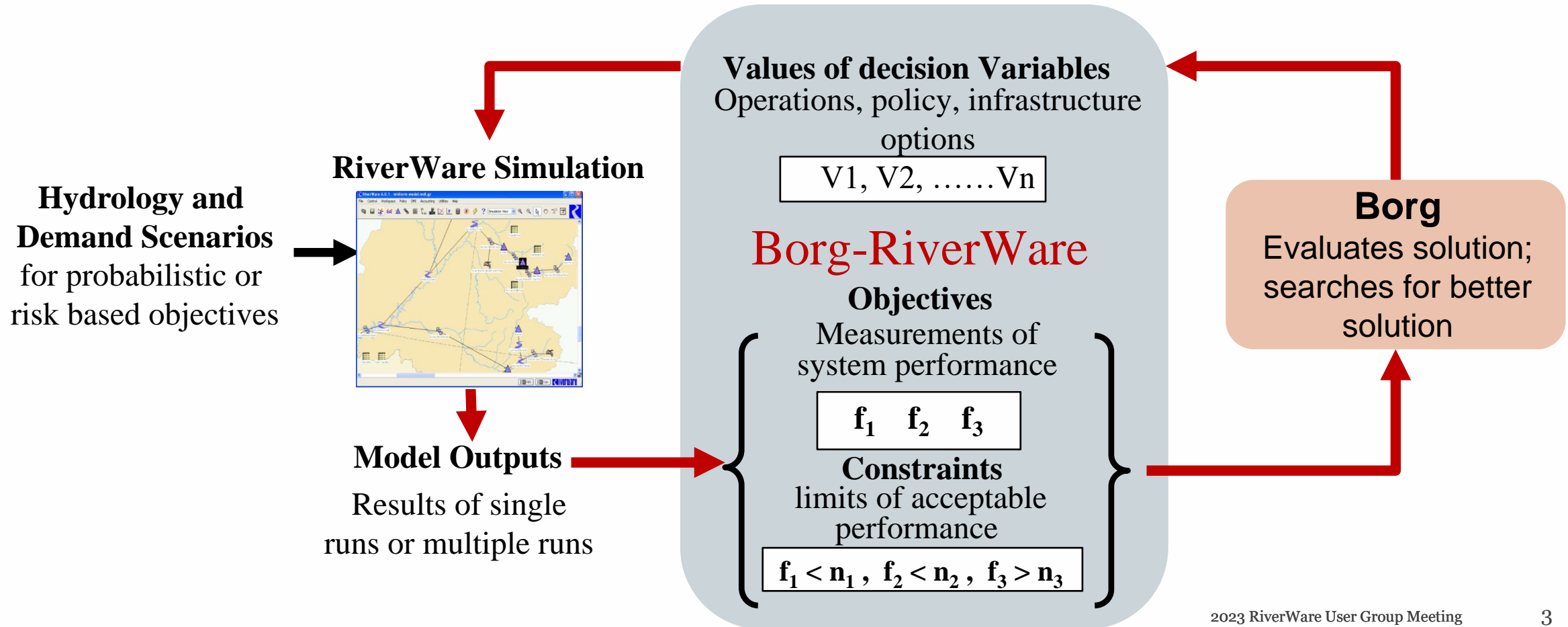
**Multi-objective evolutionary algorithm**

A search algorithm that generates many sets of variables and identifies the parato optimal solutions

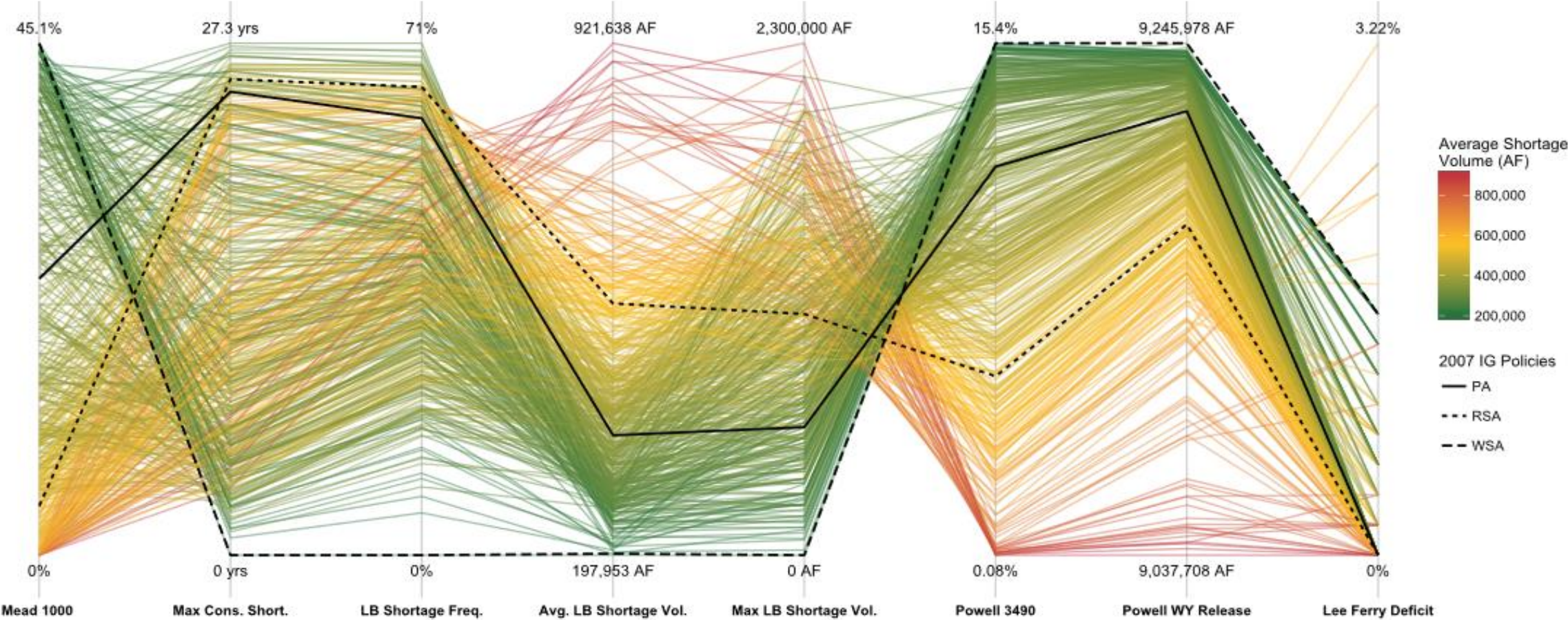
# Borg-RiverWare Wrapper

Software that exchanges information between simulator RiverWare and the MOEA Borg to find a non-dominated (pareto optimal) set of solutions

Borg is an MOEA developed by David Hadka and Patrick Reed at Pennsylvania State University and licensed by The Pennsylvania State University. See [borgmoea.org](http://borgmoea.org)



Tradeoffs among multiple objectives can be visualized using parallel coordinates plots; each axis is an objective. Each line is an approximate pareto optimal solution. (Alexander, MS Thesis 2018)



# Status of Software Development

- GUI in RiverWare for configuring the study
- GUI for Borg-RiverWare execution and debugging
- Additional study settings
- Support for single-run controllers
- Plotting for post-processing
- Improved documentation
- Software maintenance / quality control

**Still in R&D phase – not yet released as a supported product**