

Trade-off, vulnerability and power asymmetry in the Senegal River basin

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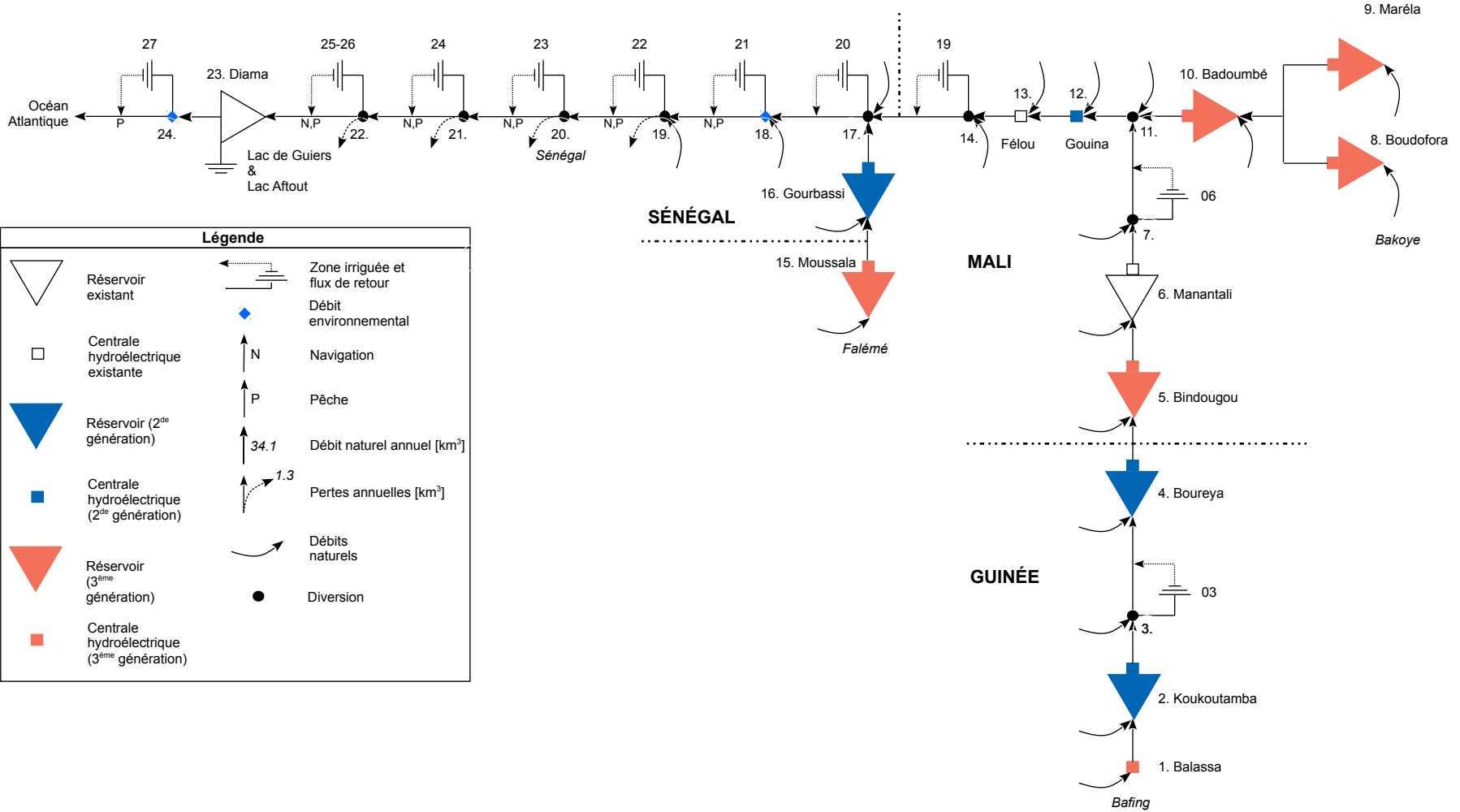
The Senegal River basin

- Located in western Africa
- Drainage area = 337000 km²
- Shared by four countries: Guinea, Mali, Mauritania and Senegal
- Traditional uses:
 - **transportation (navigation)**
 - **food production: fisheries + flood recession agriculture. Now sustained through an artificial flood**
- More recently: hydroelectricity
- Significant year-to-year variability of river discharges:
 - **exposes water users to a high hydrological risk**
- Significant development potential in the basin. Coordination through the river basin authority: OMVS

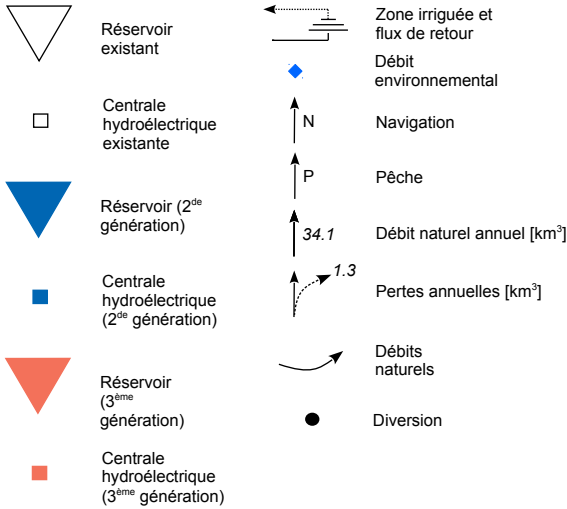
The Senegal River basin

- How do trade-offs change with respect to
 - The level of development in the basin
 - Allocation (management) priorities
- Development of a hydro-economic model
 - Determine allocation policies for different development and management scenarios
 - Constraints: M&I uses, artificial flood (eflows), navigation
 - Up to 10 reservoirs / 12 hydropower plants
 - 11 irrigation demand nodes / 52 crops
 - Optimization → WEAP

MAURITANIE

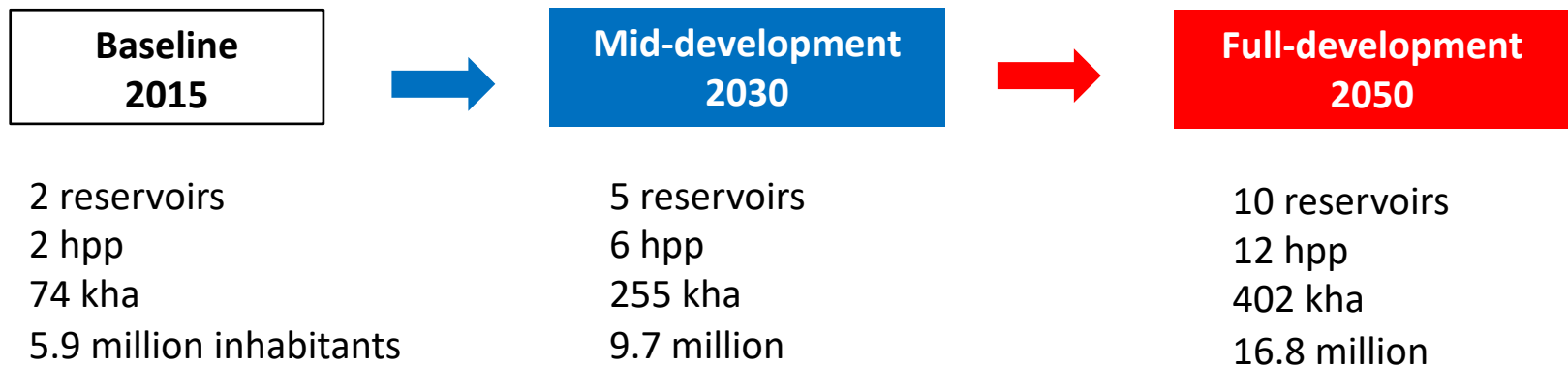


Légende



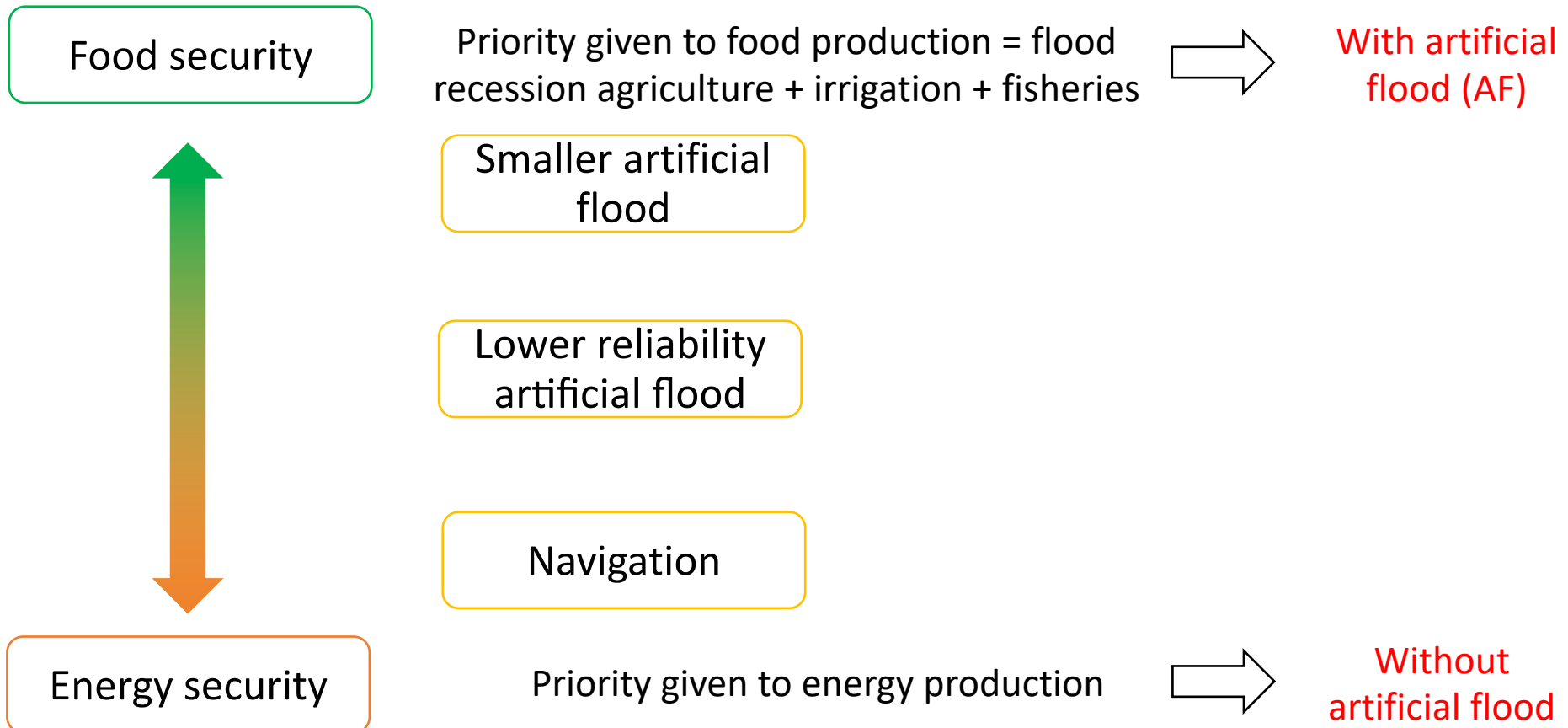
Scenarios - Senegal River basin

- Development scenarios represent alternative levels of water resources' commitment in the basin

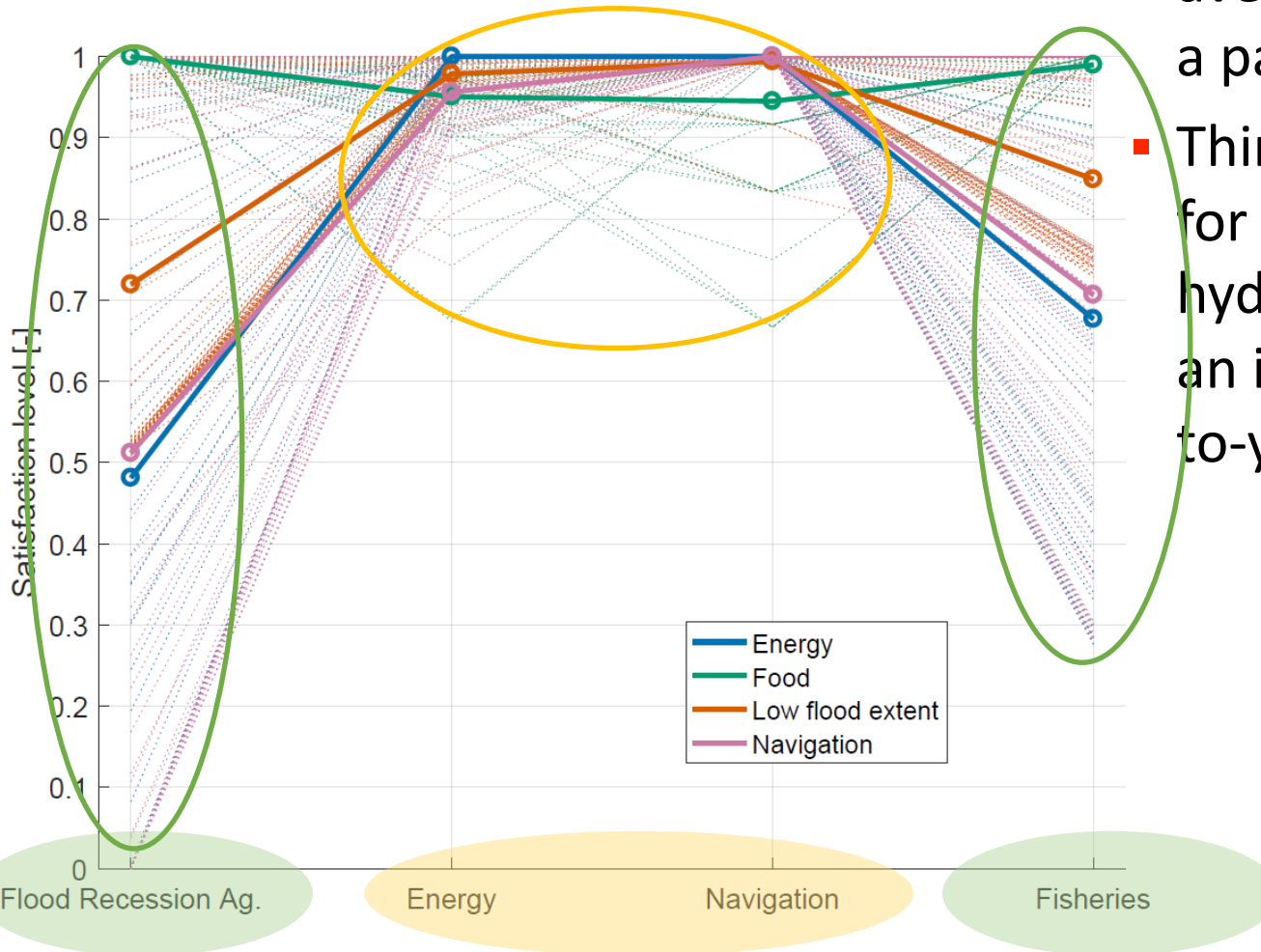


Scenarios - Senegal River basin

- Management scenarios reflect alternative allocation policies between competing uses



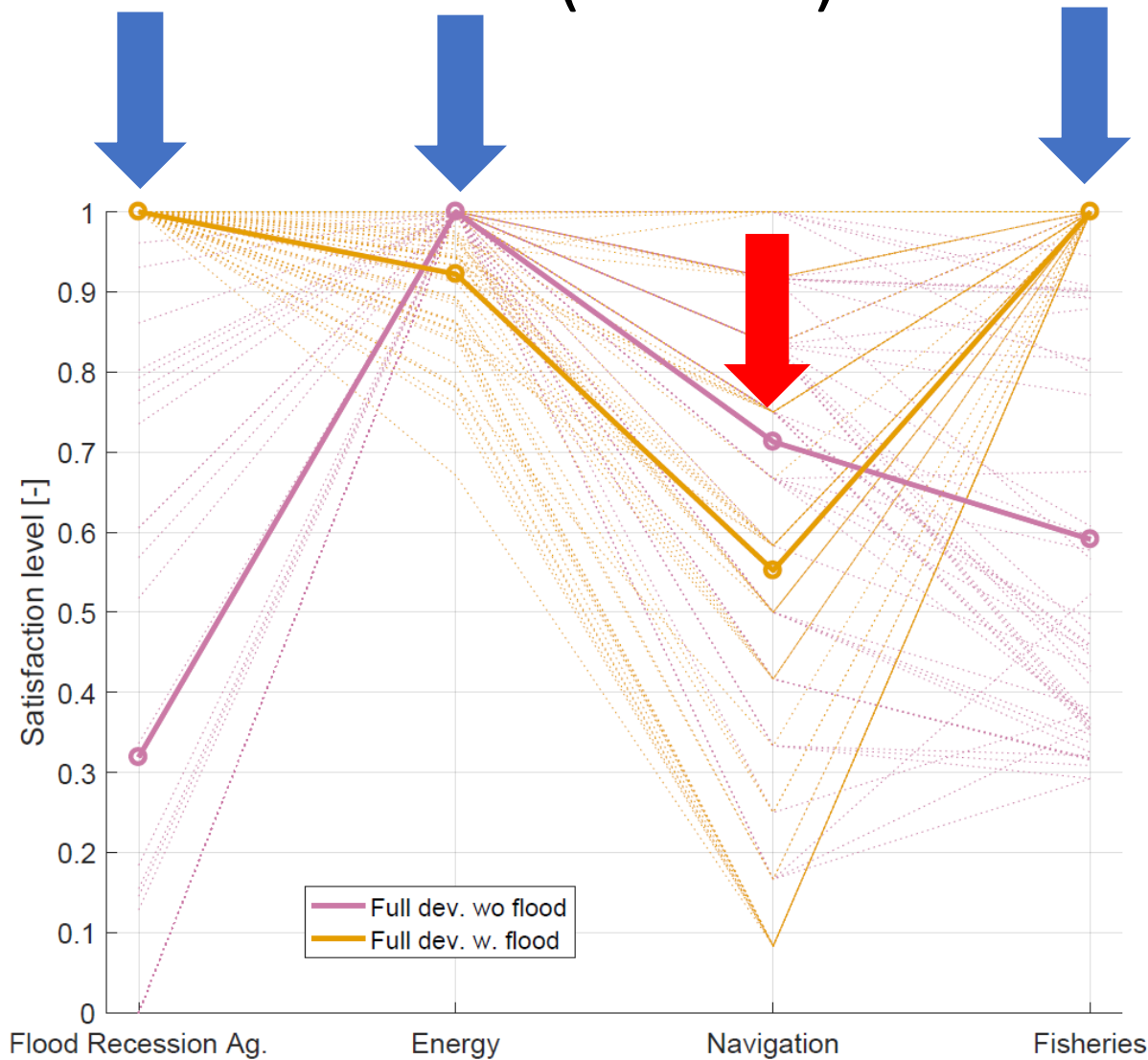
Trade-off (2030)



- The thick lines = the average performance of a particular scenario
- Thin lines = performance for a particular hydrological year → give an indication of the year-to-year variability

Traditional food production sector is more vulnerable to policy changes

Trade-off (2050)

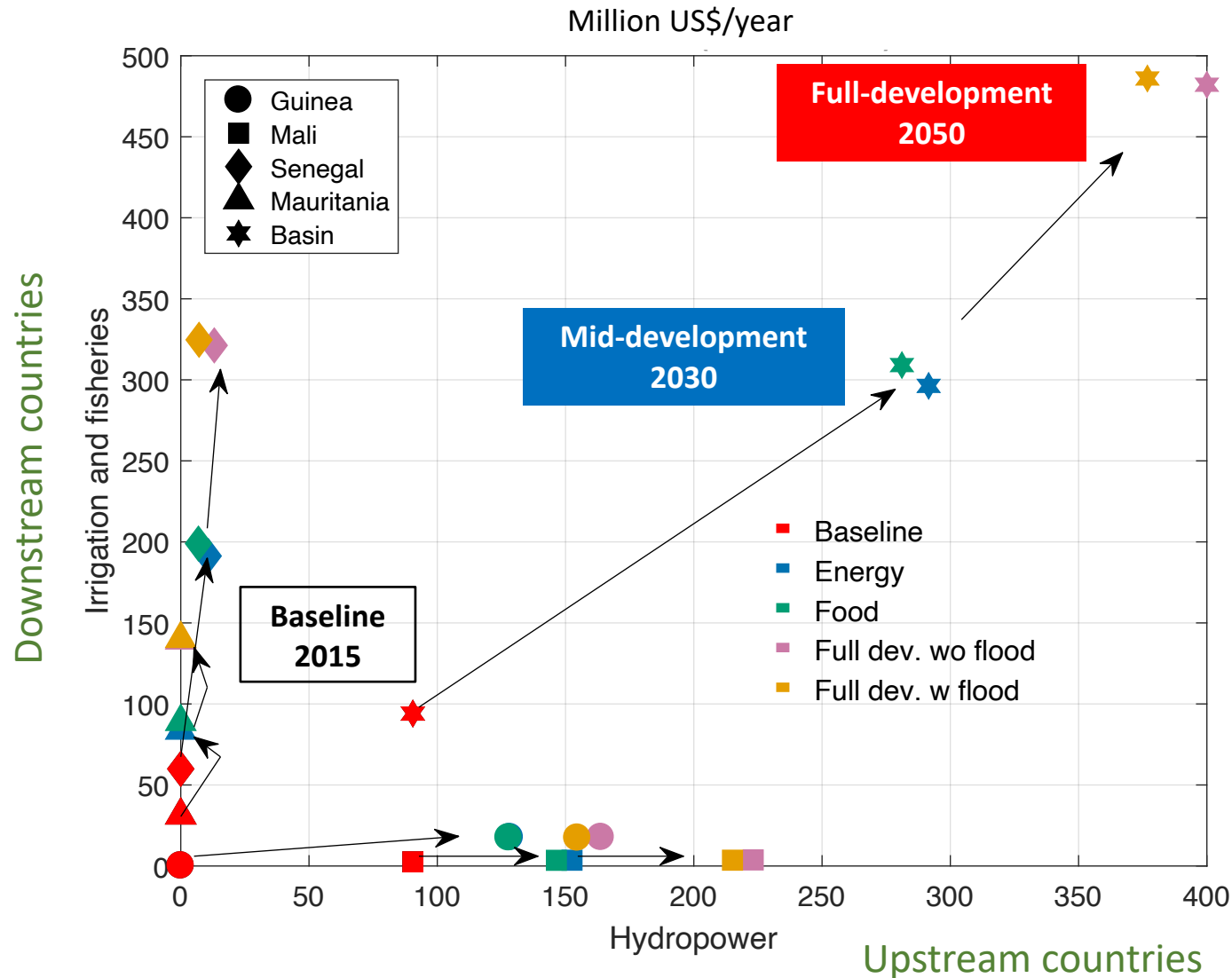


- With or without the artificial flood

+400kha irrigated agriculture means less water for navigation. Problem exacerbated if the flood is maintained

Maintaining the flood with +5 reservoirs is still possible. Opportunity cost ~ 10% energy output

Basin-wide short-run net benefits



Conclusions

- Assess the distributional impacts of water development
- Stakeholders' vulnerability to natural and anthropogenic factors affecting the availability of water in river basins
- In the Senegal River basin
 - **gains and losses are not homogeneously distributed**
 - **the vulnerability of the economic sectors and their respective agent to policy changes (allocation priority) and to the natural hydro-climatic variability is extremely different**
 - **power asymmetry. The traditional food production sector involves mostly local riverine communities. Compared to politically connected agribusinesses and power companies, those local communities are much more vulnerable to factors affecting the flow regime.**
- Ongoing work. Incorporation of climate change
- More info: <https://doi.org/10.1016/j.jhydrol.2020.124915>