

Pathways to achieve the 1.5 °C target in Europe based on land-based mitigation

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Research questions:

- How can Europe make a proportional contribution to the 1.5 target through land-based mitigation?
- Can it do so while producing enough food?
- What are the consequences for land cover change?

Normative Targets:

- Food production: 2500 kcal/capita/day (self-sufficient level of food production¹)
- Afforestation: 152,669 km² ↑ (8.7% ↑ to the current level : Bonn Challenge global target² is to increase 3,500,000 km² by 2030 – Europe shares about 4.36% of global forest)

Methods and Materials

CLIMSAVE Regional Integrated Assessment Platforms (IAPs)

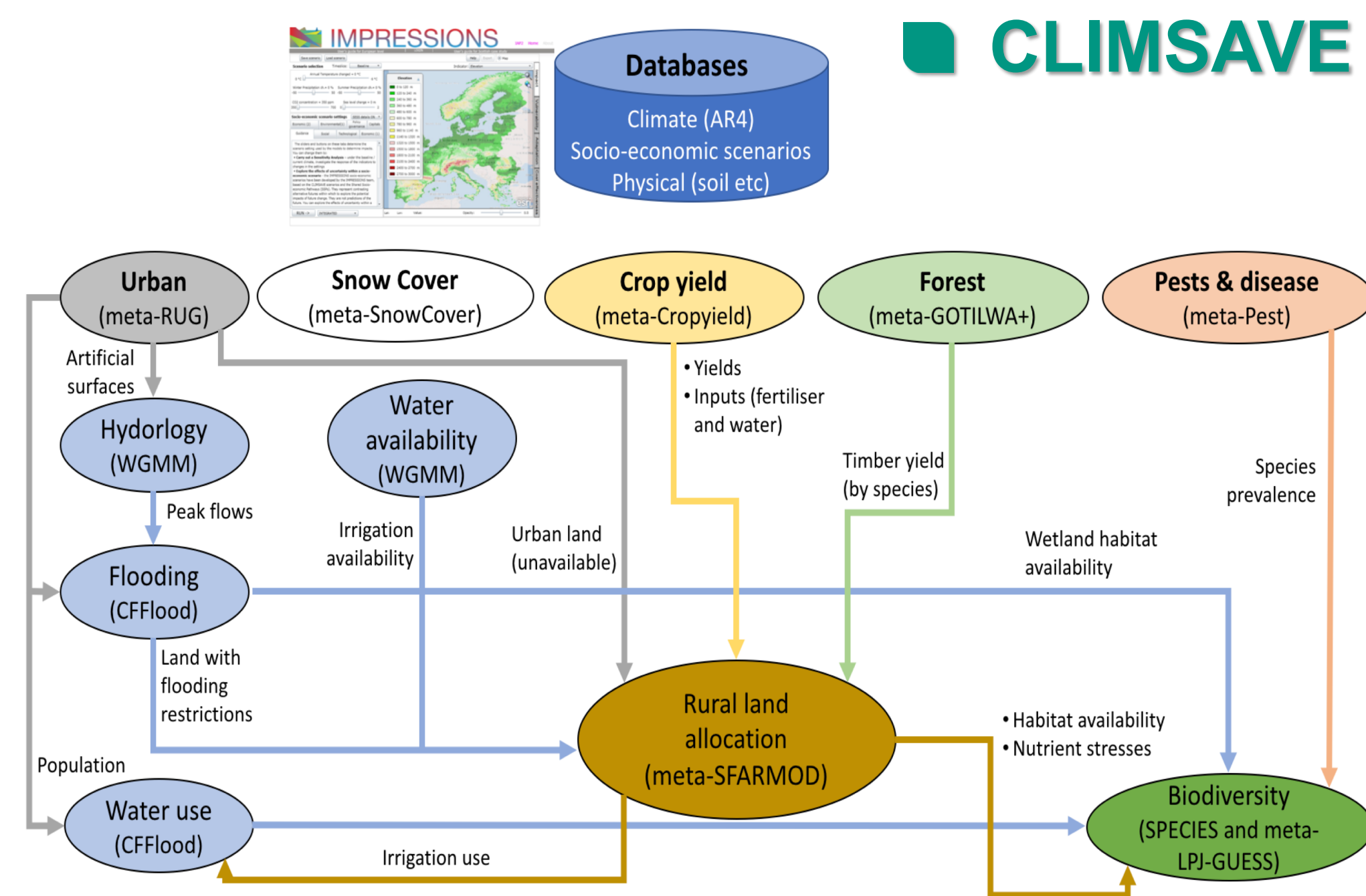


Fig 1. Schematic figure showing the data transfers between the models within the CLIMSAVE IA Platform (adapted from Harrison et al. 2013)

Step 1: Scenario evaluation

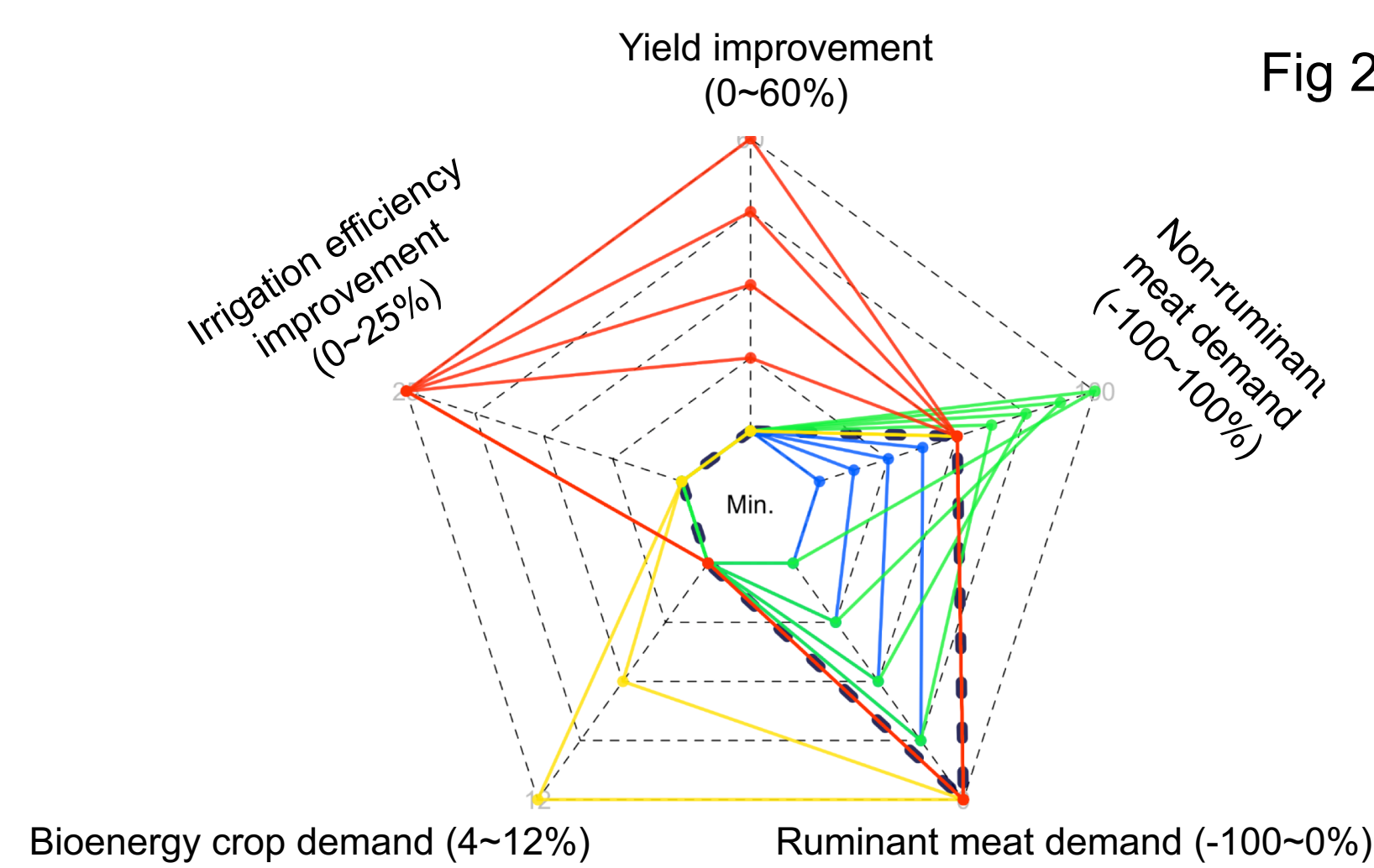


Fig 2. Characteristics of scenarios

- S1 Reference (n= 3)
- S2 Less meat consumption (n= 12)
- S3 Changed dietary preference (n= 12)
- S4 More bioenergy (n= 6)
- S5 Technology improvement (n= 12)

Step 2: Searching for the feasible conditions (N_{batch runs} = 810)

Results

(1) Land cover change in different scenarios

- There was **no single case** to meet the targets by changing one option.

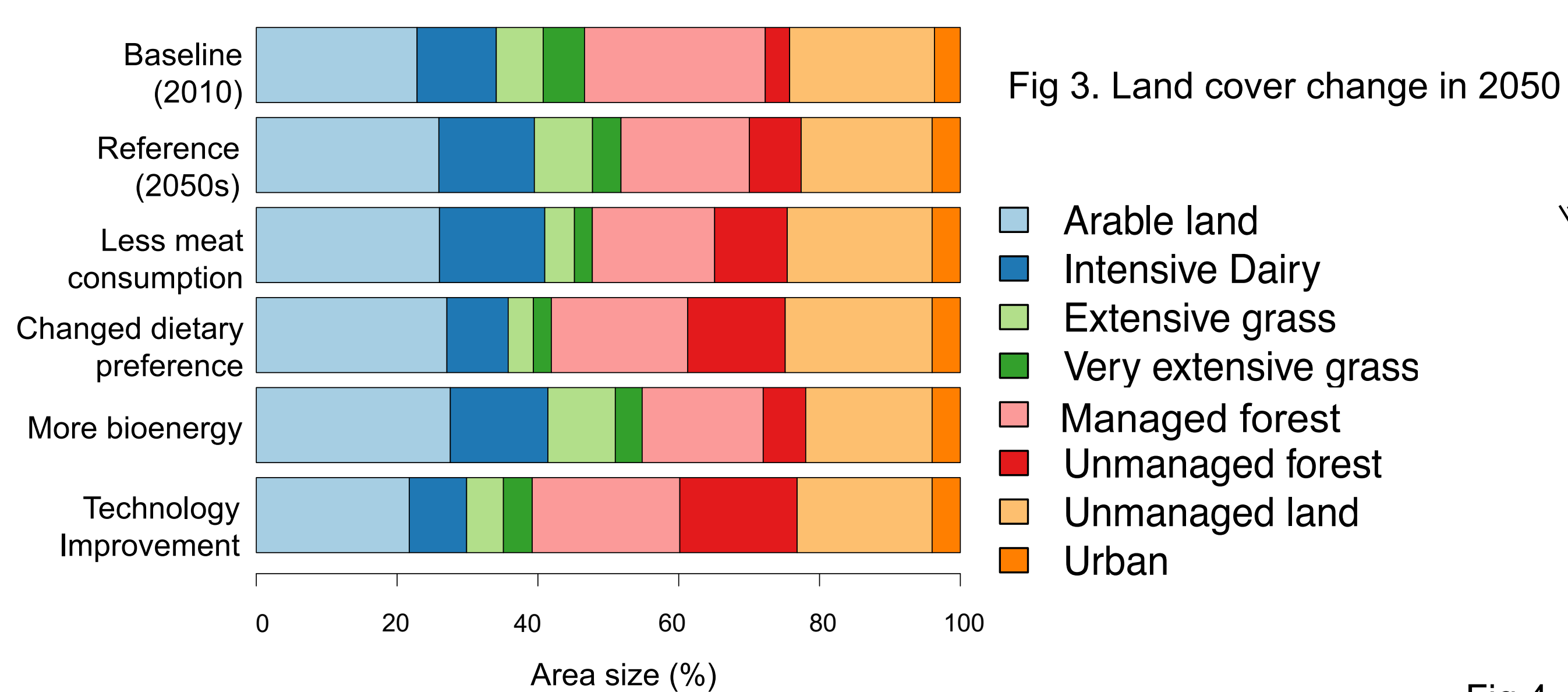


Fig 3. Land cover change in 2050

(2-1) Combinations of options that met food and afforestation targets: N_{successful runs} = 34 (4% of runs)

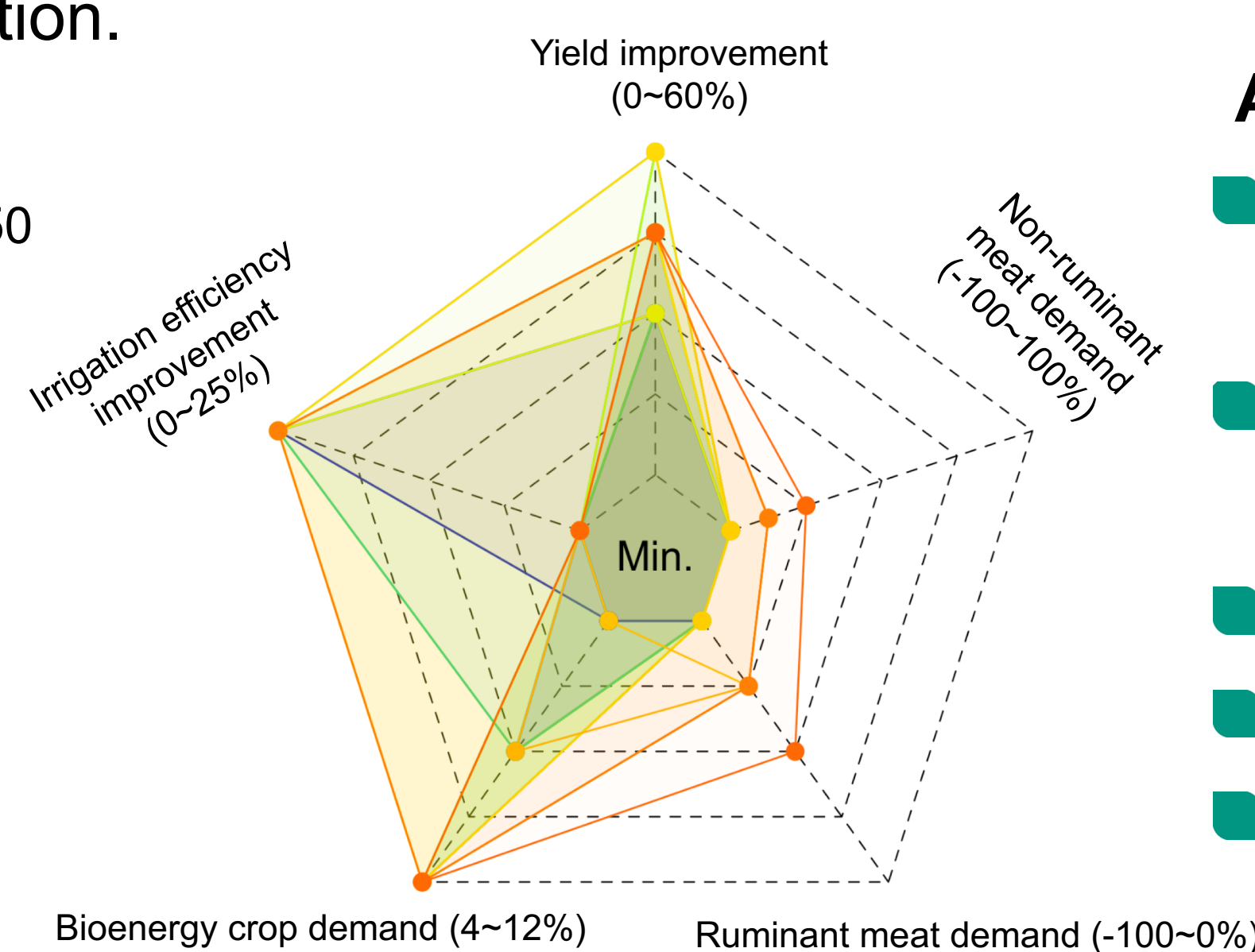


Fig 4. Characteristics for the successful runs (n=34, 4% of runs)

Avg. options for the successful runs

- Ruminant meat demand: **94.85% reduction** ↓ [-100, -50]
- Non-ruminant meat demand: **94.85% reduction** ↓ [-100, -50]
- Irrigation efficiency: **9.6% ↑** [0, 25]
- Yield improvement: **42.8% ↑** [30, 60]
- Bioenergy: **9.1% ↑** [4, 12]

Take home messages

- Without at least 50% of reduction in meat consumption, Europe will not achieve the 1.5 °C target.
- Land management policy should encourage landowners to use unmanaged forest/land as an additional carbon storage source.

(2-2) Land transition from baseline to successful runs

- Reduced meat consumption decreases extensive and very extensive grassland.
- Reduced arable/grassland is converted to unmanaged forest and unmanaged land, providing more opportunity to grow trees and bioenergy crops.
- Unmanaged forest will not be used for timber production, thus has a high potential for carbon storage.

References

- Porkka M, Kummu M, Siebert S, Varis O (2013) From Food Insecurity towards Trade Dependency: A Historical Analysis of Global Food Availability. PLoS ONE 8(12): e82714.
- http://www.bonnchallenge.org
- Harrison et al. (2013) Combining qualitative and quantitative understanding for exploring cross sectoral climate change impacts, adaptation and vulnerability in Europe, Reg Environ Change 13:761-780

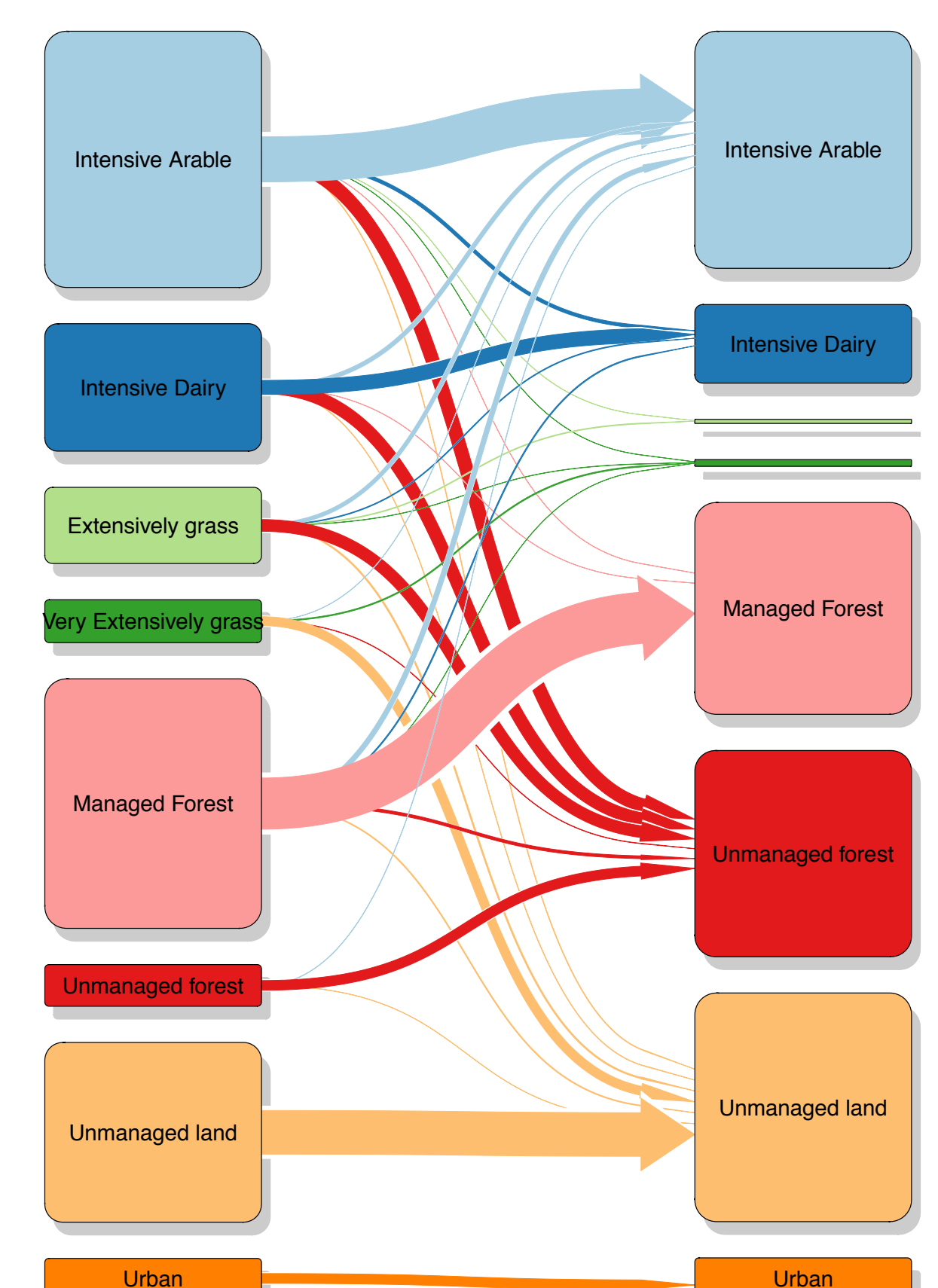


Fig 5. Land transition from baseline to successful runs