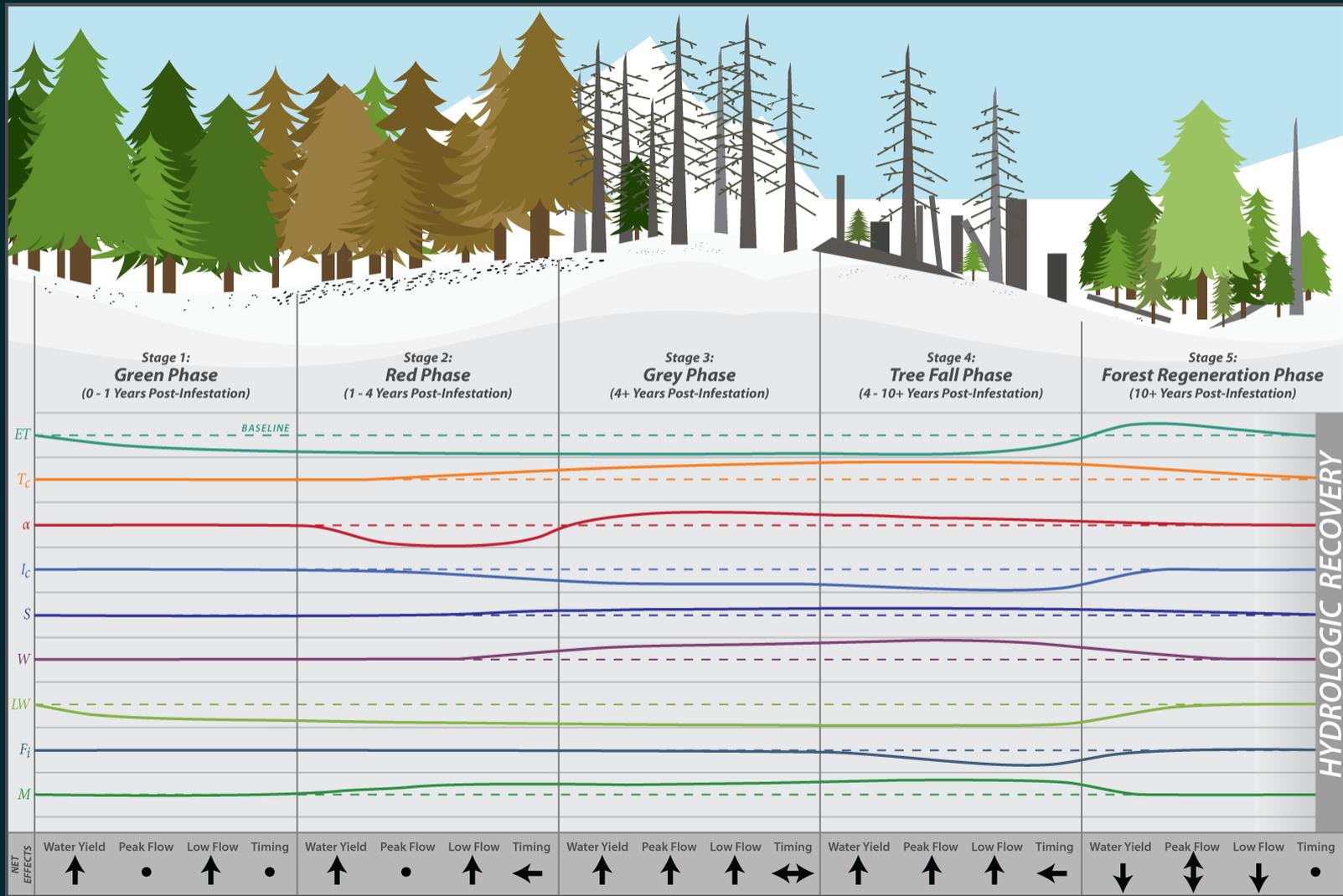
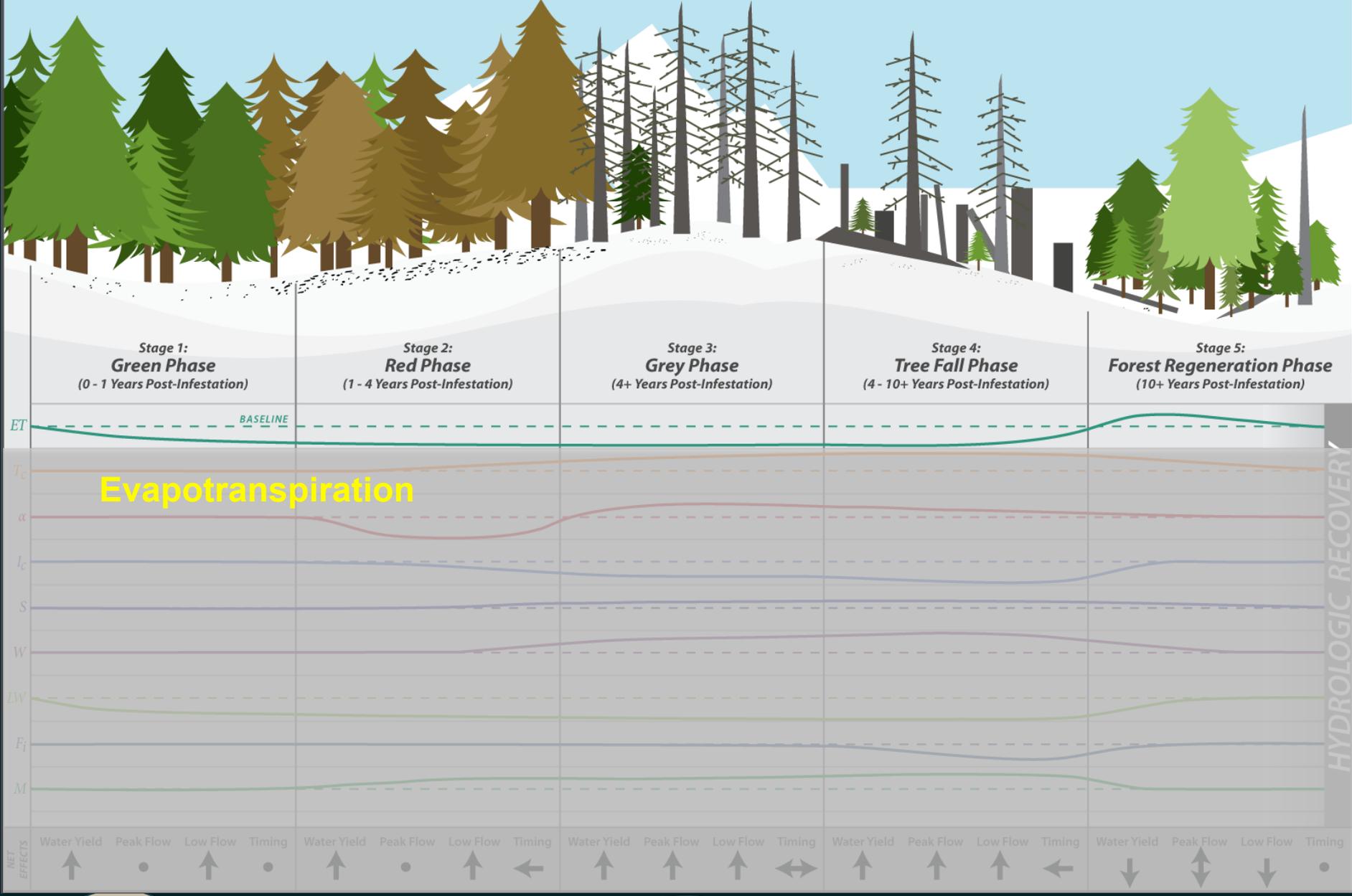
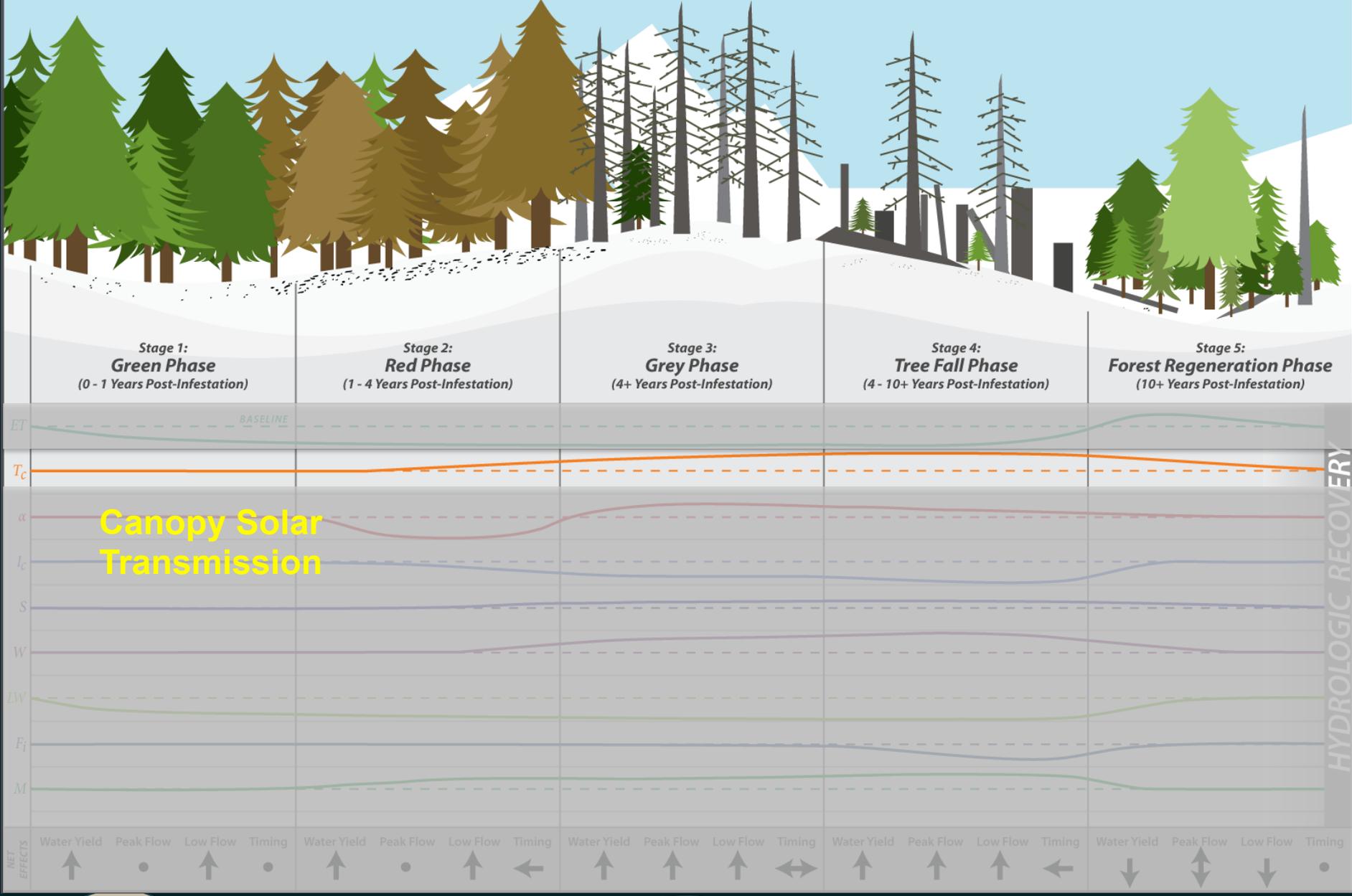


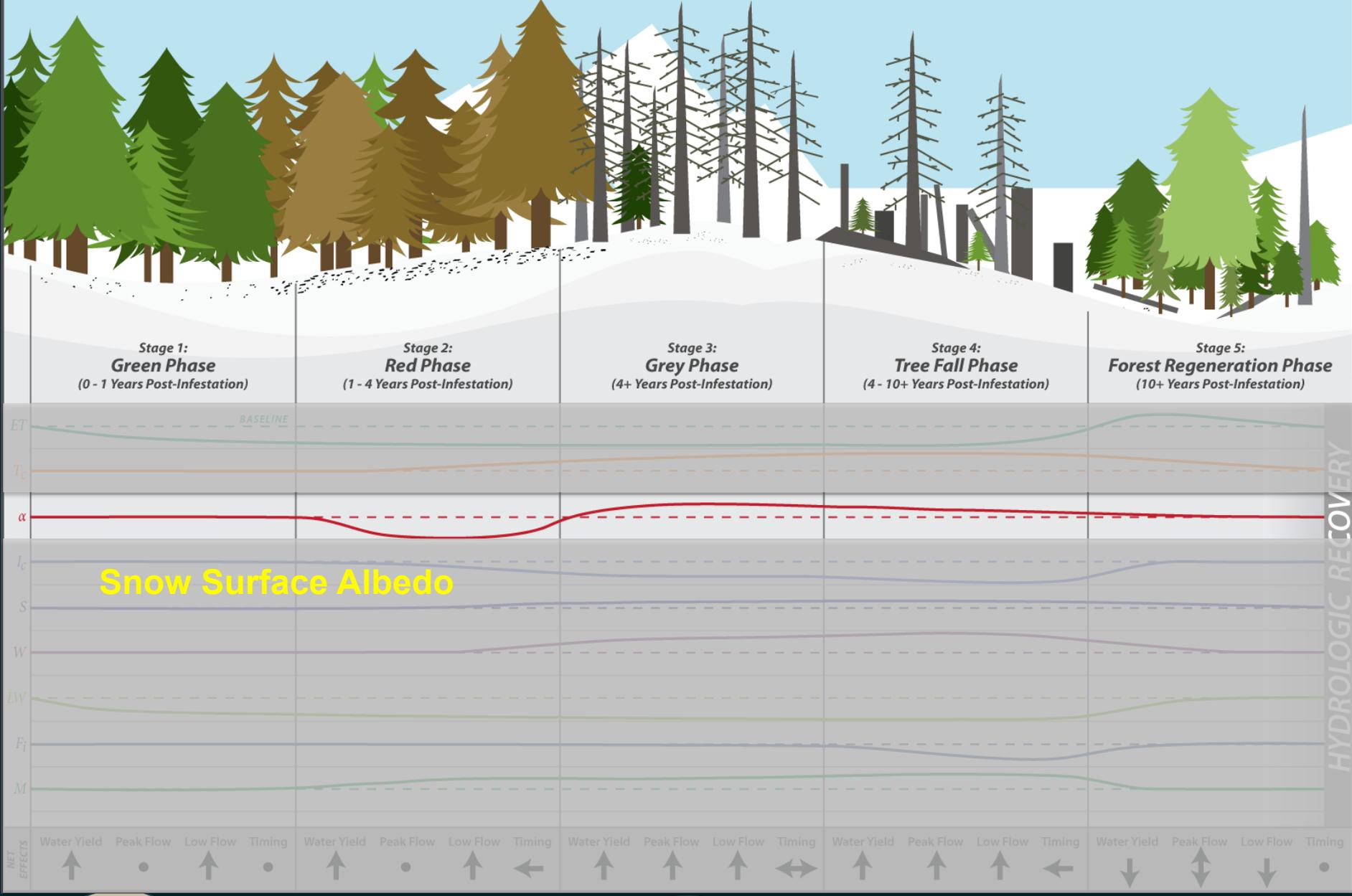
Hydrologic Impacts at Stand Scales: Conceptualized Implications for Water Yield

Conceptual Model of Stand-Scale Impacts



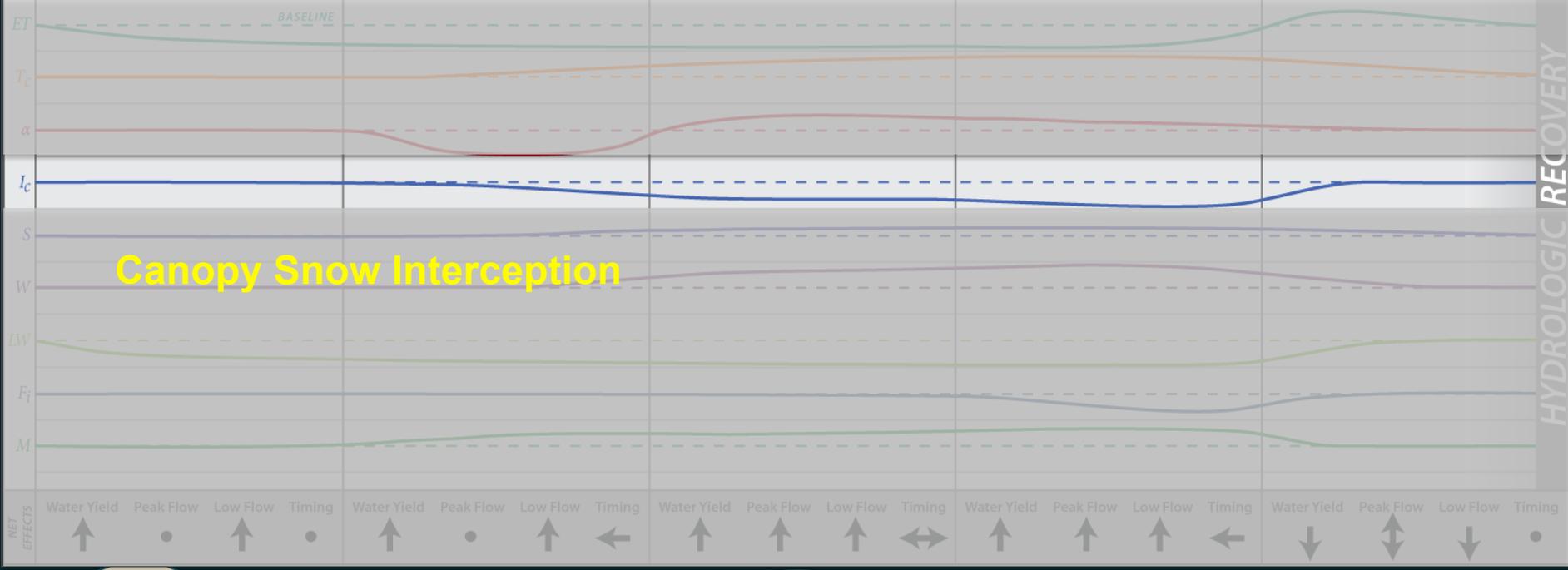






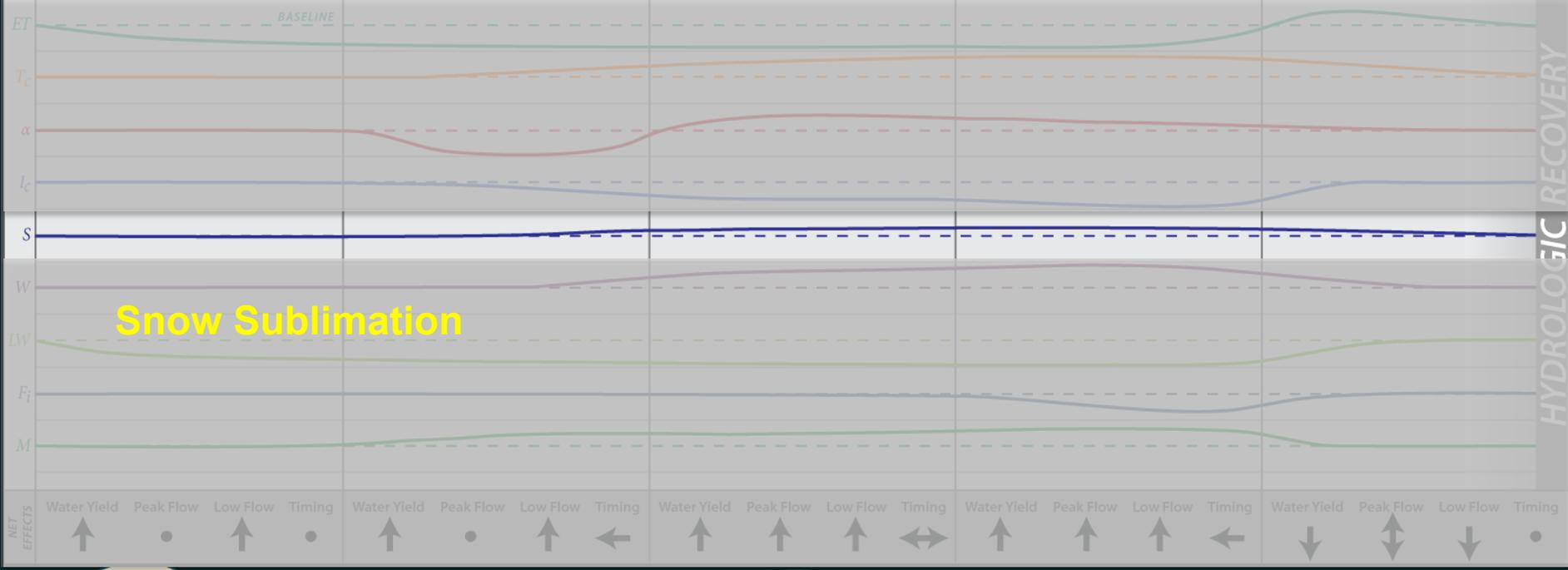


Stage 1: Green Phase (0 - 1 Years Post-Infestation)
Stage 2: Red Phase (1 - 4 Years Post-Infestation)
Stage 3: Grey Phase (4+ Years Post-Infestation)
Stage 4: Tree Fall Phase (4 - 10+ Years Post-Infestation)
Stage 5: Forest Regeneration Phase (10+ Years Post-Infestation)



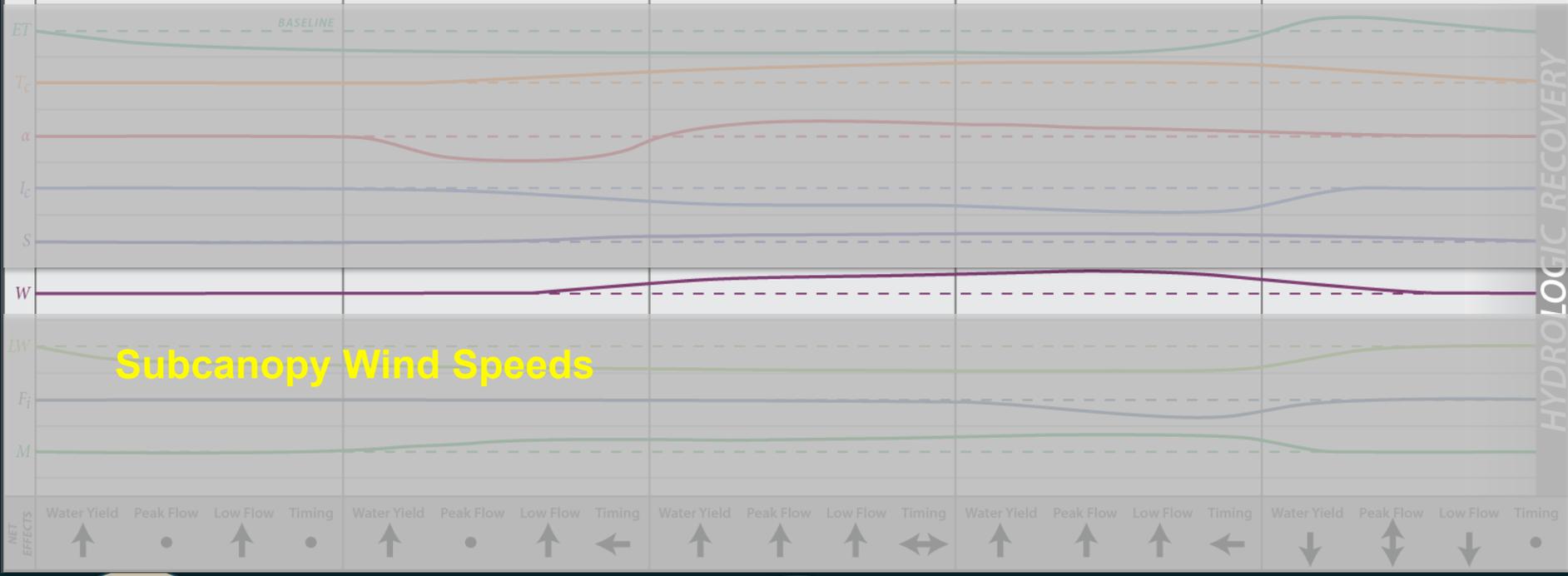


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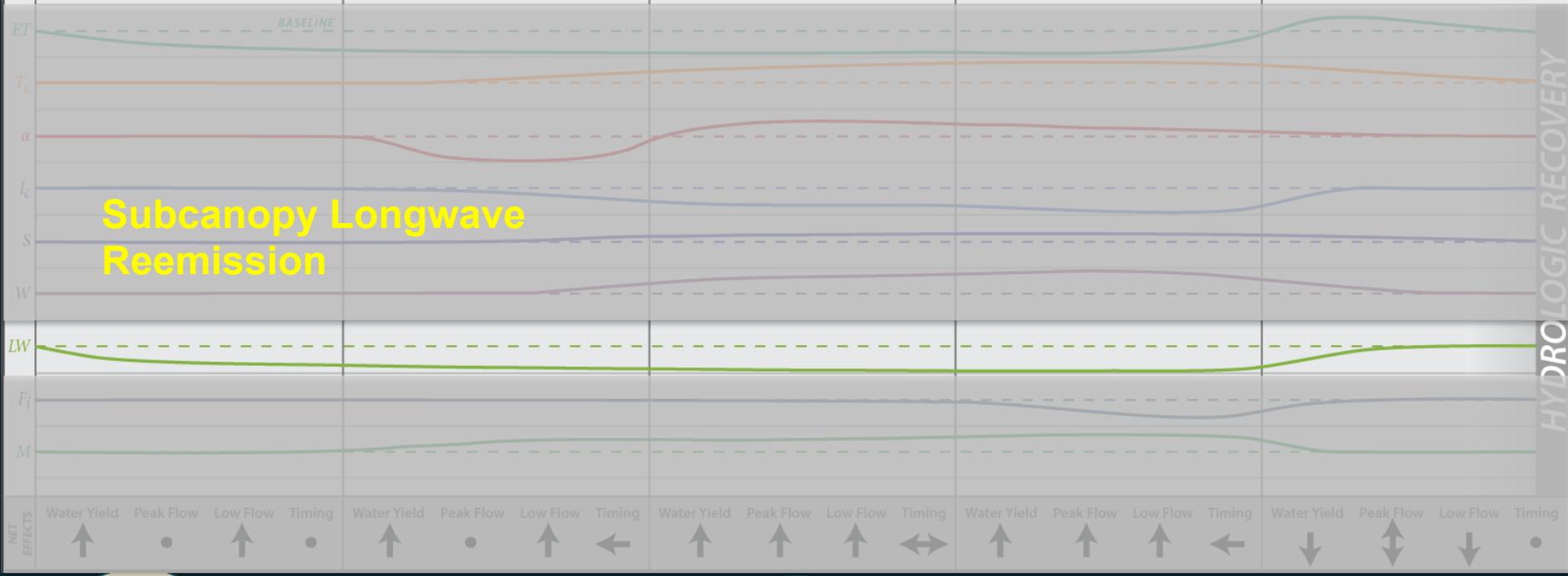


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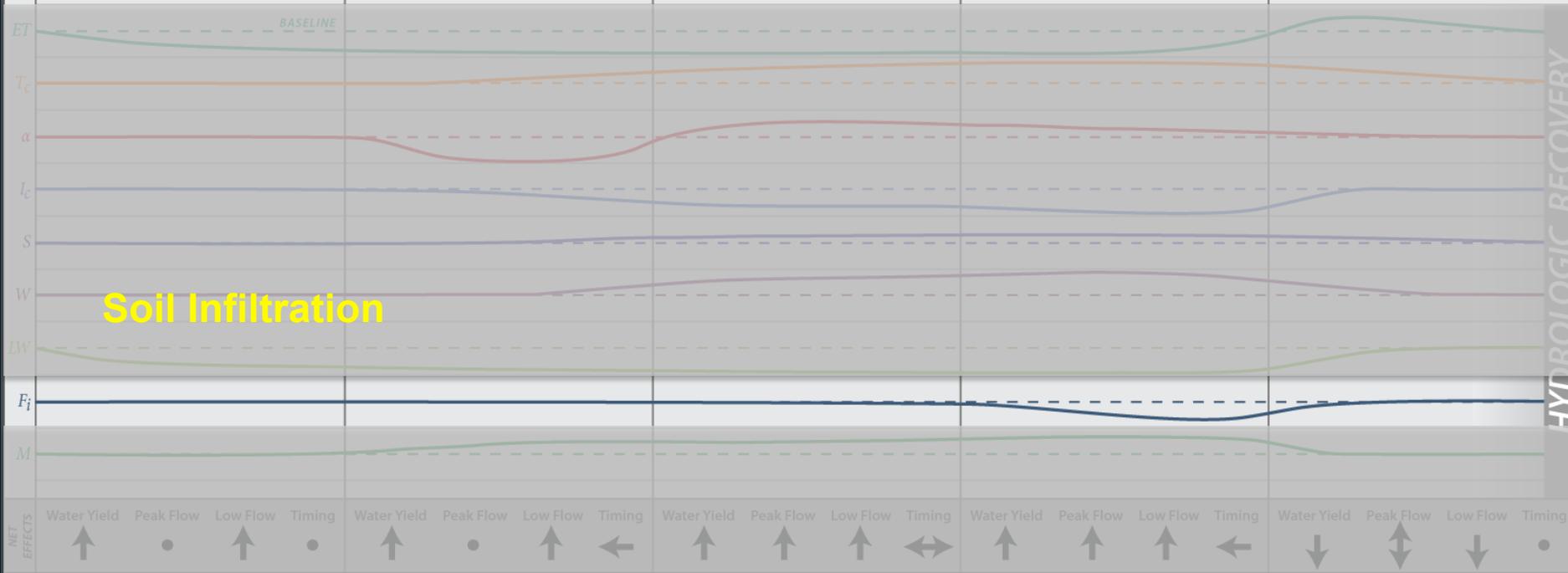
**Stage 1:
Green Phase**
(0 - 1 Years Post-Infestation)

**Stage 2:
Red Phase**
(1 - 4 Years Post-Infestation)

**Stage 3:
Grey Phase**
(4+ Years Post-Infestation)

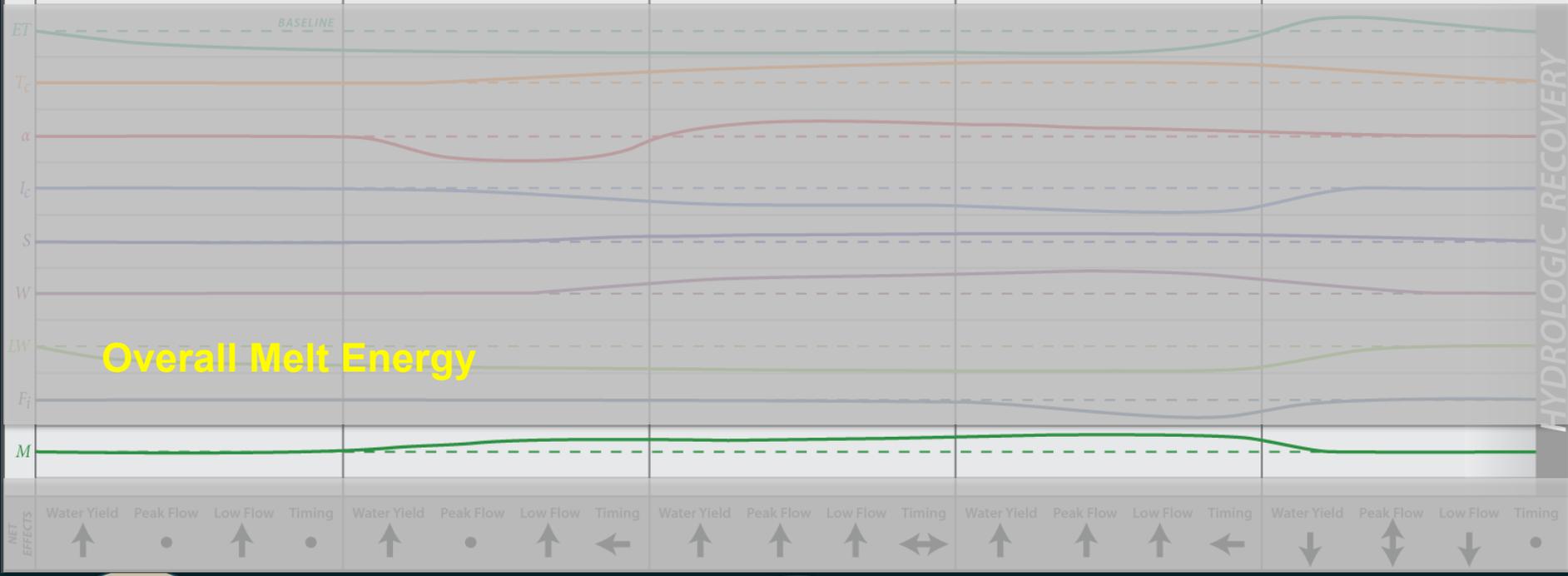
**Stage 4:
Tree Fall Phase**
(4 - 10+ Years Post-Infestation)

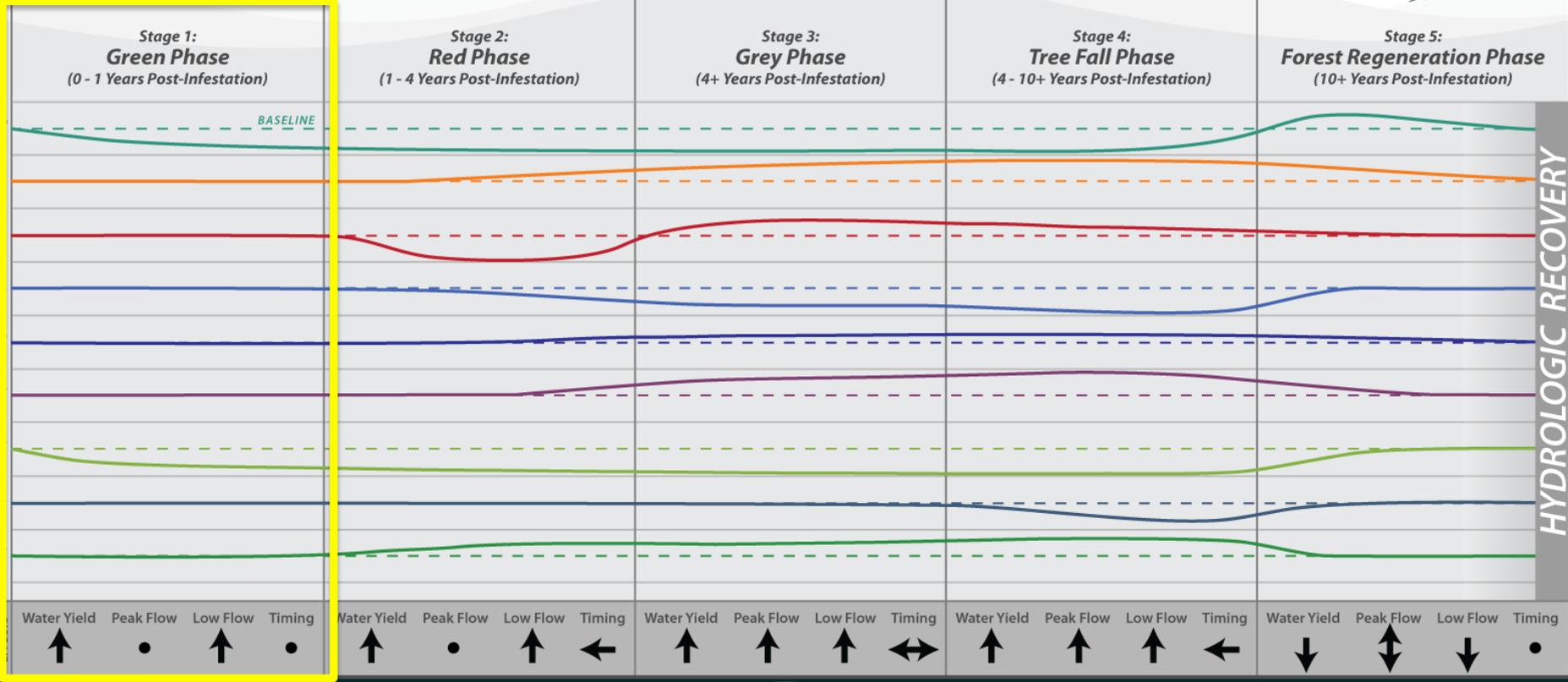
**Stage 5:
Forest Regeneration Phase**
(10+ Years Post-Infestation)



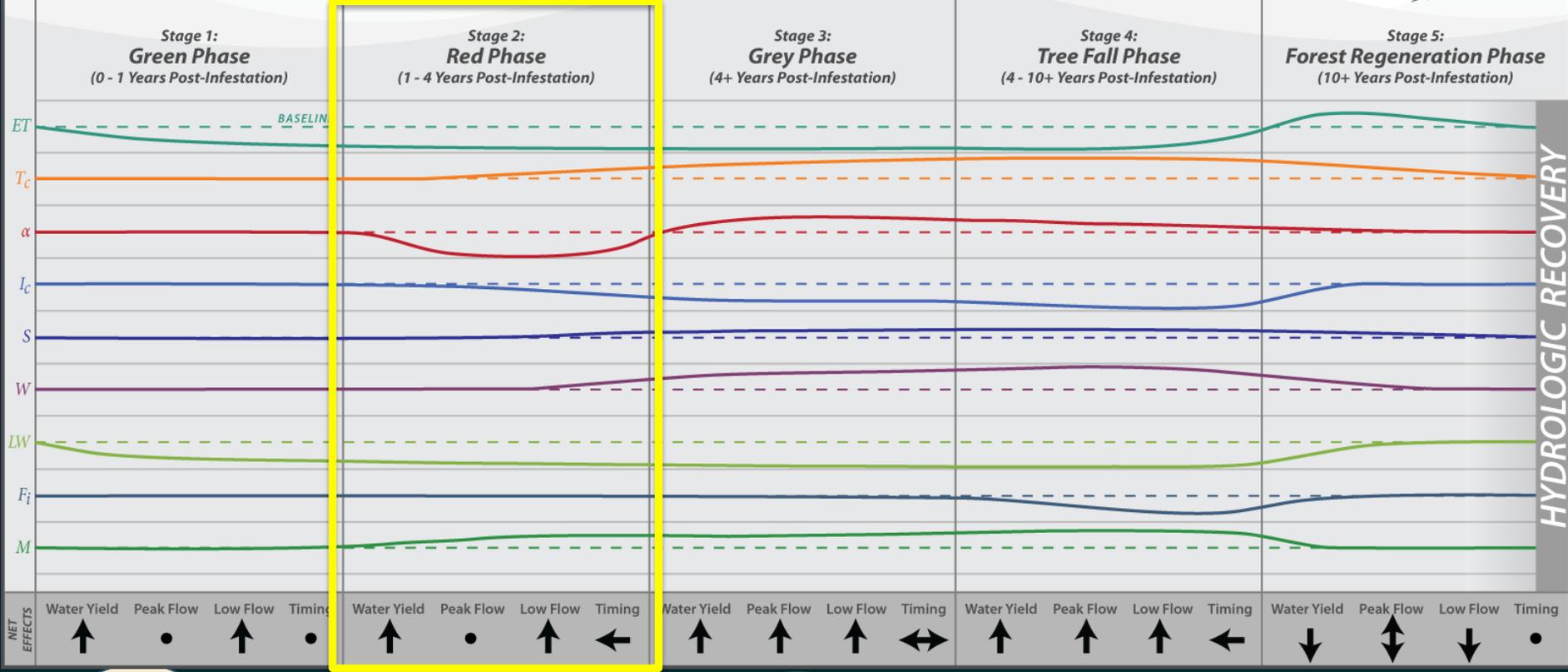


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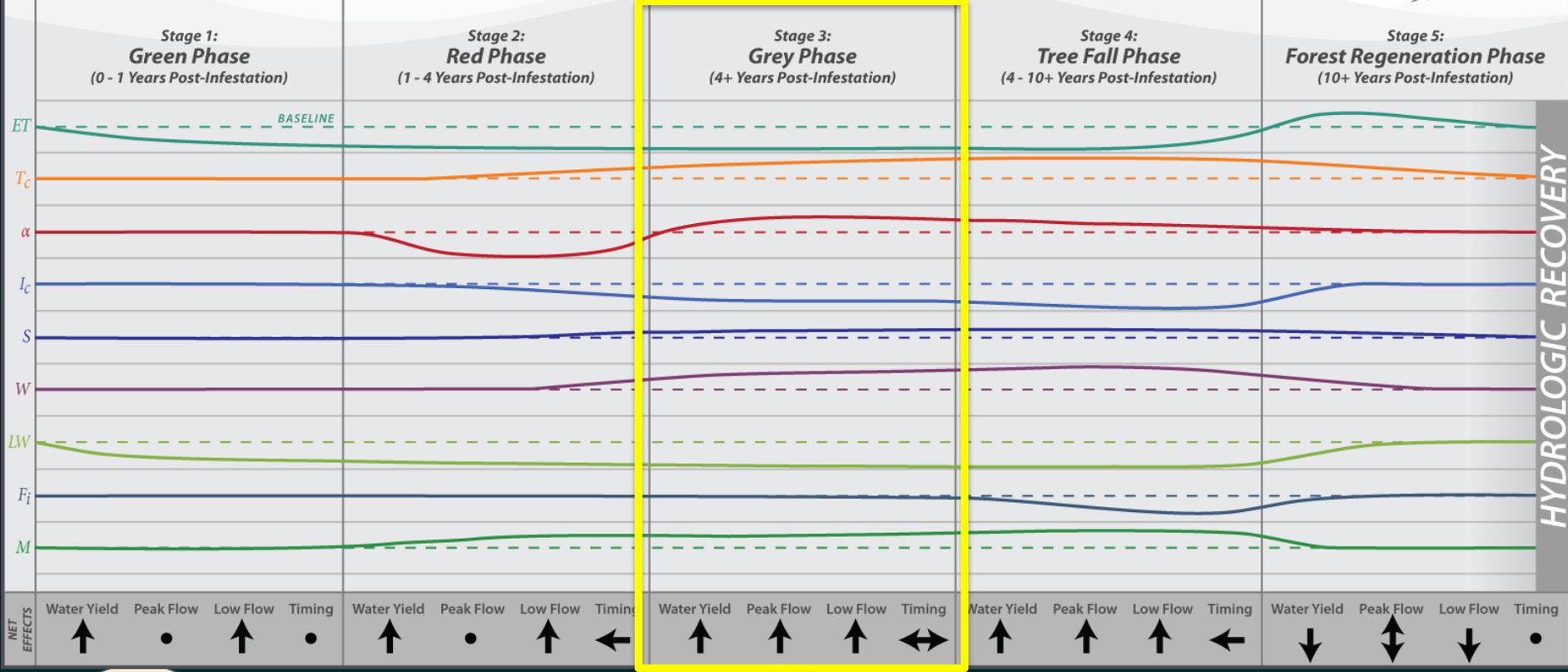


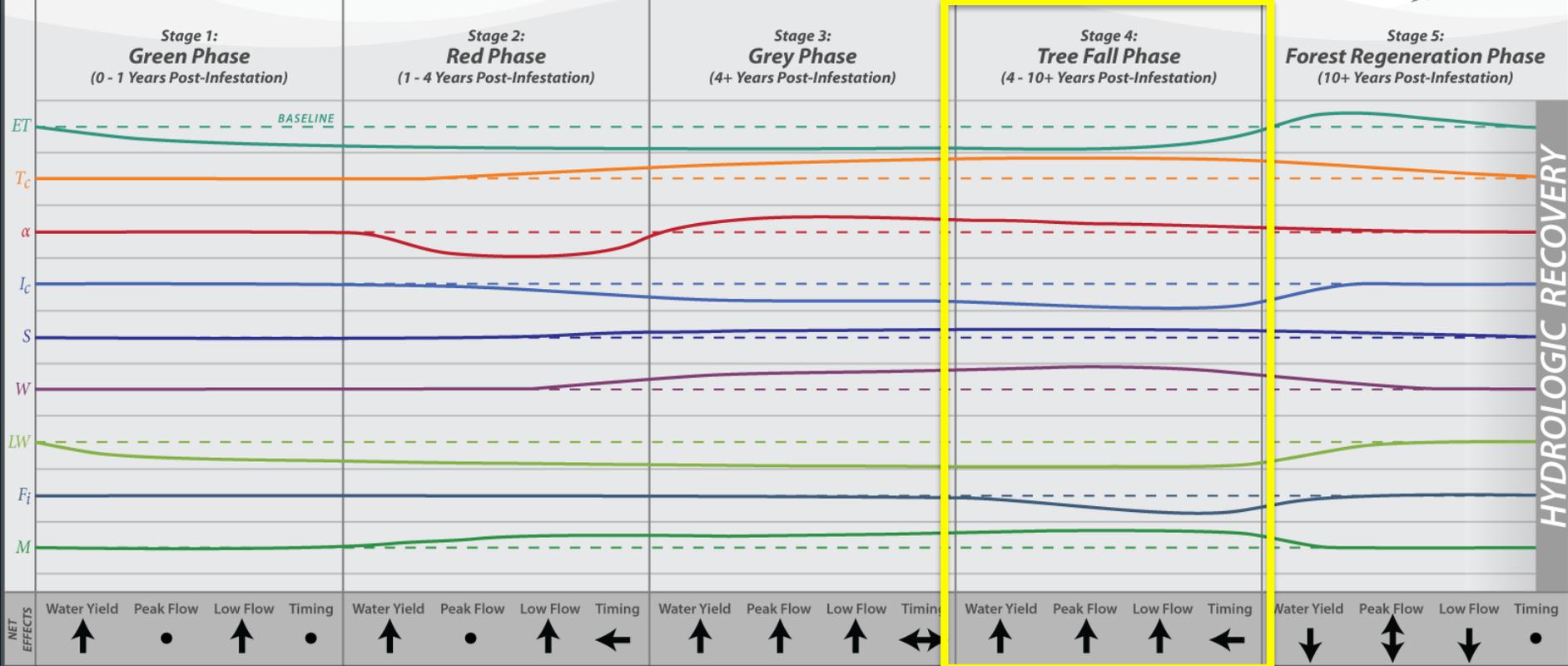


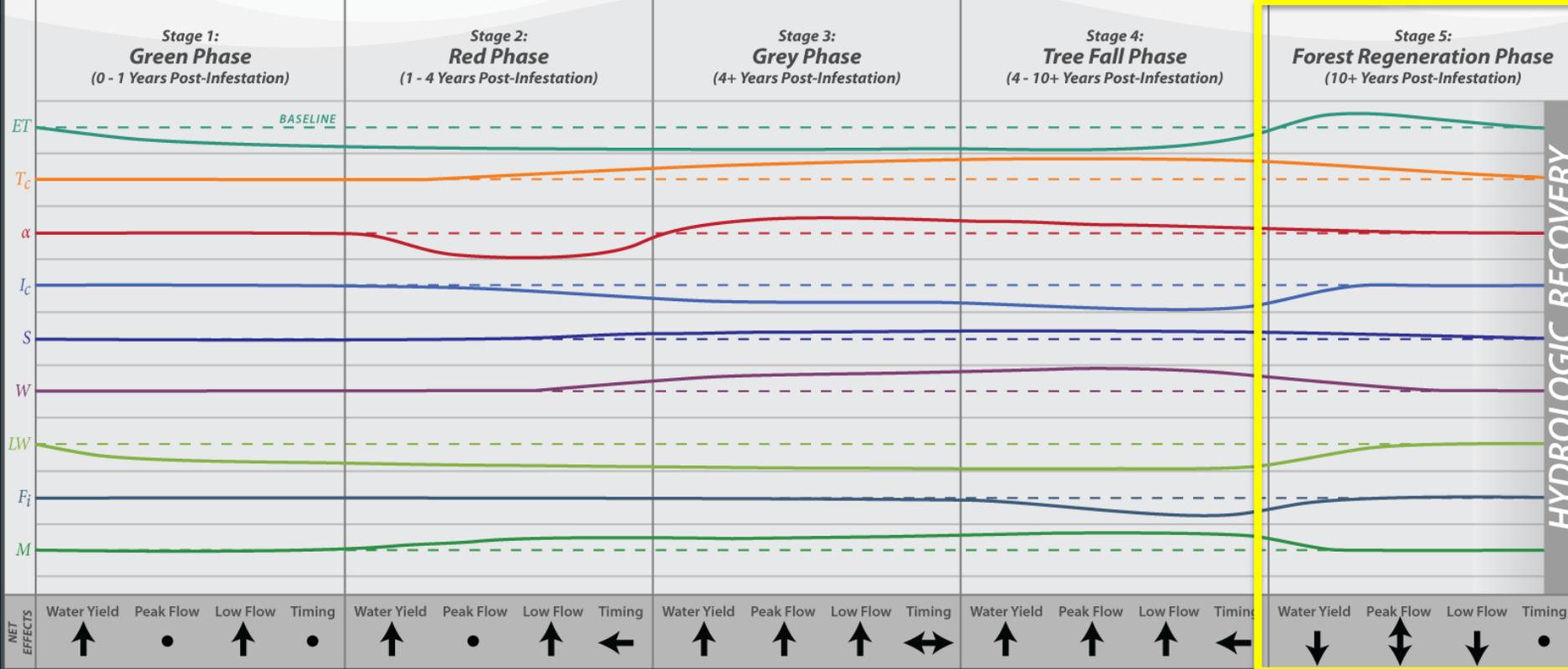
HYDROLOGIC RECOVERY



HYDROLOGIC RECOVERY







NET EFFECTS	Water Yield	Peak Flow	Low Flow	Timing
Stage 1	↑	•	↑	•
Stage 2	↑	•	↑	←
Stage 3	↑	↑	↑	↔
Stage 4	↑	↑	↑	←
Stage 5	↓	↕	↓	•

Pugh and Gordon (2011, in review)

Confounding Factors

Forest Characteristics	Watershed	Climate/Weather	Mortality
Species Composition	Elevation	Temperature	Rate of Change
Stem Density	Slope	Precipitation	Total Extent of Mortality
Canopy Leaf Area	Aspect	Humidity	Extent of Each Mortality Phase
Canopy Geometry	Basin Area	Wind Speed	
Tree Height	Forested Area	Cloudiness	

Take-Home Message

- Stands die slowly and pass through multiple stages, often at the same time; makes prediction difficult
- Remaining live, smaller trees and stand structure makes beetle-killed forests different from clearcuts or fire
- Effects can be highly dependent on site-specific factors
- Need better understanding of how stand-scale processes aggregate to larger-scale effects on hydrology

