An overview of the hydrological models used in LANDWISE for the simulation of the effects of land-based NFM measures

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LANDWISE NFM

Aims of land-based NFM and hydrological processes involved

Land-(management) based NFM measures aim to:

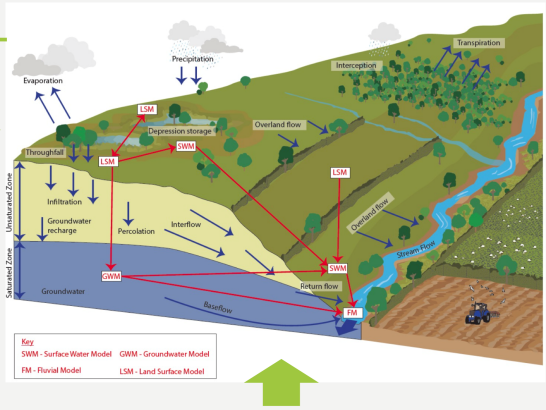
❑ **Retain water** in the soil/landscape
- ❑ Soil water retention by managing infiltration and runoff
- ❑ Soil management by improving storage and percolation
- ❑ Crop choice & rotation, to increase root water uptake
- ❑ Woodlands: see above, and increased interception

Field & Farm-level scale

Land-scape scale

❑ **Make space** for above-ground water storage & attenuation
- ❑ Water storage areas on land surface
- ❑ Riparian buffers
- ❑ River and floodplain restoration

Model processes



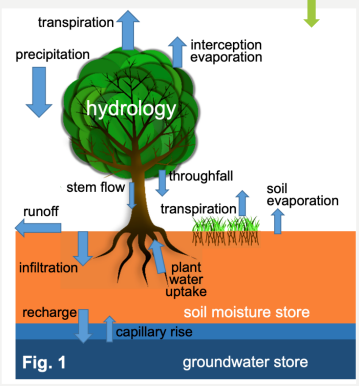


Fig. 1

Models can help us assess:
- ❑ The effectiveness of different measures
- ❑ How the effectiveness varies seasonally and between years (antecedent conditions, precipitation magnitude and duration)

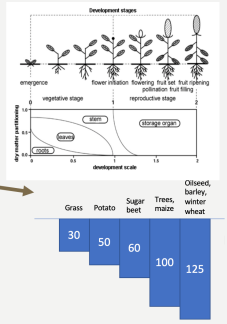
Models, scales, processes, NFM

Scale	Modelling platform	Hydrological processes	NFM measures considered
Field scale (<10ha) Translatable to other areas with similar soils, landscape, land management, climate	Land surface model - SWAP	Rainfall, interception, evaporation & transpiration, soil storage, runoff, infiltration, recharge	Soil water retention, Soil management, Crop choice & rotation, Woodlands
Small-medium catchment (<1,000km²) Provides context for various catchment types	Land surface models – SWAT, ZOODRM	Rainfall, interception, evaporation & transpiration, runoff, infiltration, recharge	SWAT: Soil water retention, Soil management, Crop choice, Woodlands; ZOODRM: Soil water retention, Woodlands
	Surface water model – JFlow	Rainfall, runoff, losses (soil storage), return flow/baseflow	Water storage areas, Riparian buffers, River and floodplain restoration

Approach for large catchment (>1,000km²) scale currently under discussion

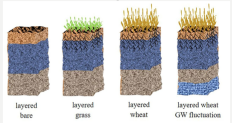
Kind of model input data required

- ❑ Soil water retention & flow properties (NATMAP or HOST soil classes, farmer info WP1)
- ❑ Dates of sowing/planting & harvest; max. root depths (farmer info)
- ❑ Leaf Area Index (LAI), e.g. to determine interception/ transpiration
- ❑ Surface 'roughness' for runoff, e.g. via curve number method



NFM simulated via:

- ❑ Multi-year 1-D (field-scale) model simulation runs using multiple 'scenarios' (grassland, crop rotation or typical woodland species)
- ❑ Small-medium catchment-scale simulation runs with more restricted scenarios
- ❑ Models driven with weather data representing short, intense summer storms; prolonged winter storms, lower magnitude events & climate change



Key differences between models:

- ❑ Type of soil information required (full shape of water retention curve; SWAP) or key points only (field capacity and wilting point; ZOODRM, SWAT)
- ❑ How run-off is modelled (e.g. via curve number (SWAT) or Manning-type equations (SWAP), or various options (Jflow))
- ❑ Interception of rainwater by vegetation (e.g. option to differentiate between crops/grass & forest; strength of dependency on LAI)
- ❑ Static LAI (ZOODRM); or crop & forest growth, that depends on weather (SWAP, SWAT)
- ❑ Plant water stress (FAO p-factor in ZOODRM or mechanistic approaches in SWAT & SWAP) for transpiration

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