

Upper Wharfe strategic NFM modelling

Steve Rose

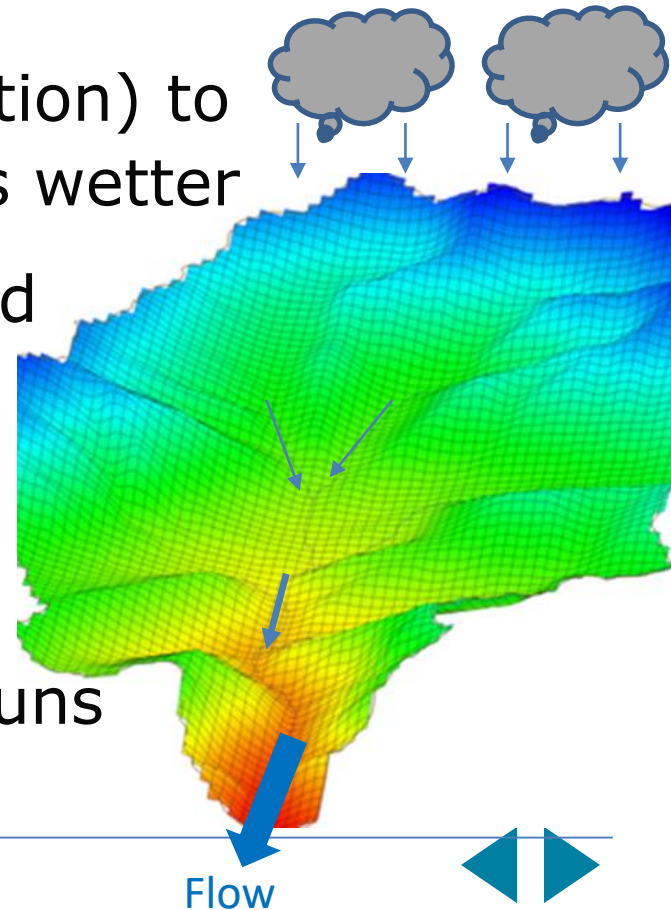
Scope

- Broad scale NFM feasibility modelling in 2017
- Upper Wharfe catchment to edge of YDNPA boundary near Addingham (over 400 sq km)
- JFLOW 2d surface water flood model
- Modelling approach consistent with uFMfSW (2012)
- Continuous 2m bare earth DTM
- Use of readily available spatial datasets
 - Woodlands for Water Opportunity Maps
- NT/YDNPA new woodland plantings
- Determination of relative change (before & after NFM)



Surface Water Flood Model

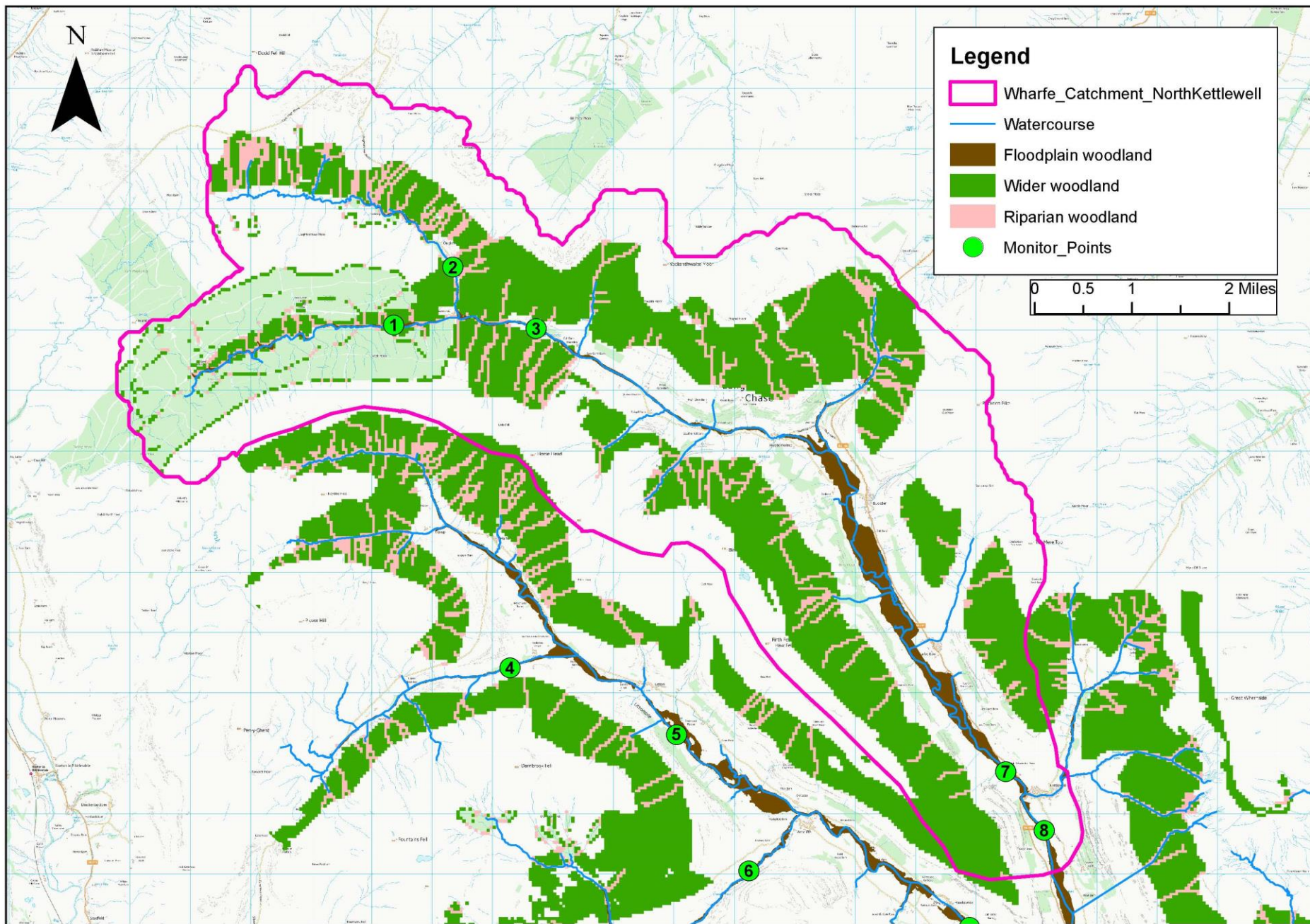
- Rainfall event hyetograph dropped onto 2m bare earth DTM of catchment and allowed to flow downslope
- Model permits soil losses (infiltration) to reduce through event as soil gets wetter
- Hydraulic roughness (friction) grid related to the ground cover (e.g. woodland, bare rock, grasses)
- Baseline (no change) model runs
- After change (with NFM) model runs

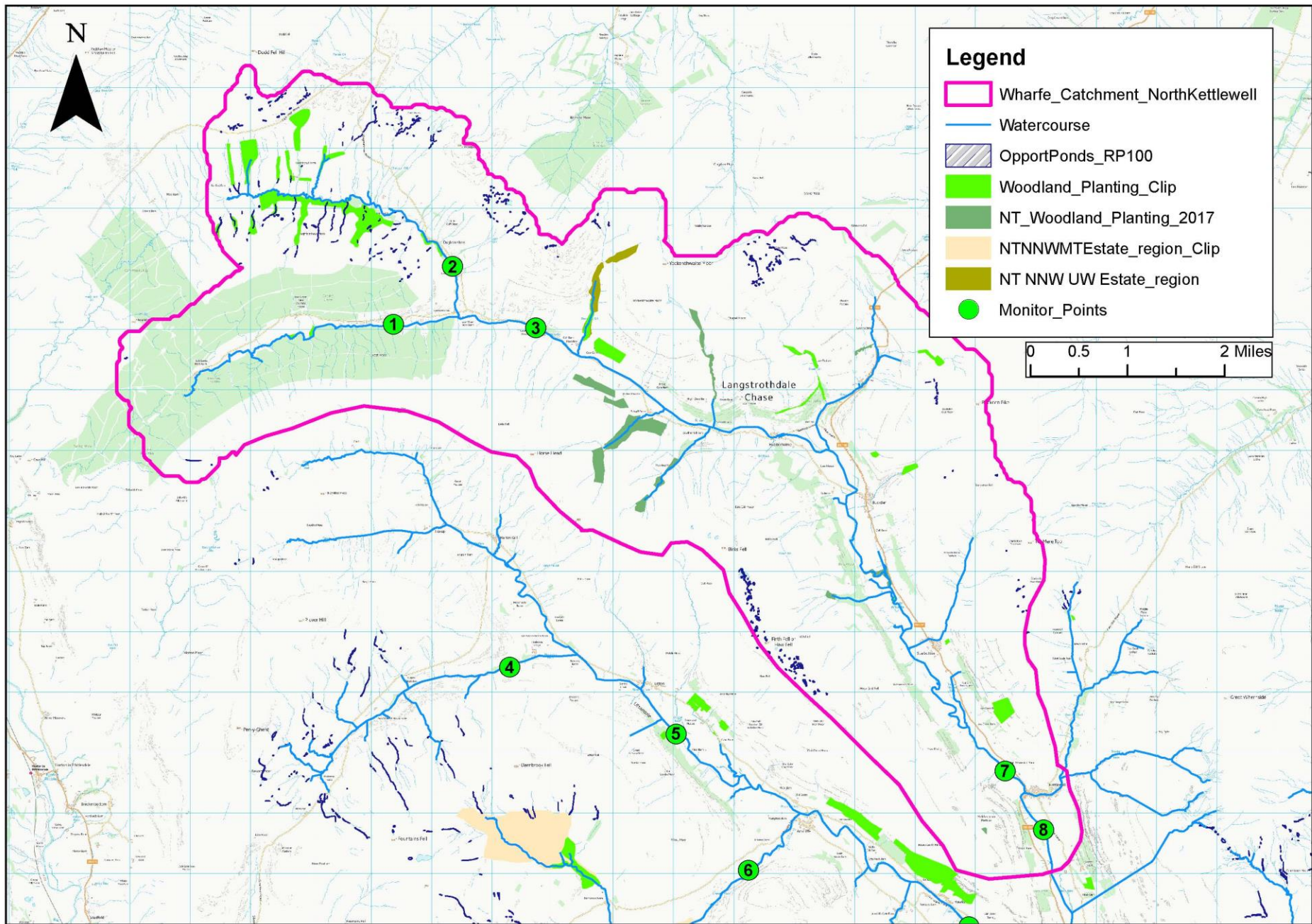


Modelling

- 10 year, 30 year & 100 year design rainfall events
- Baseline (no change) scenario
- Main NFM options modelled:
 - Woodlands for Water (catchment, riparian, floodplain)
 - Vegetated buffer strips beside watercourses
 - Soil structural improvement under grassland
 - NT/YDNPA new woodland plantings
 - Runoff Attenuation Features (RAFs)
 - Combination of features
- NFM features represented by:
 - DTM manipulation
 - Surface roughness modification
 - ReFH losses model modification (e.g. soil infiltration)







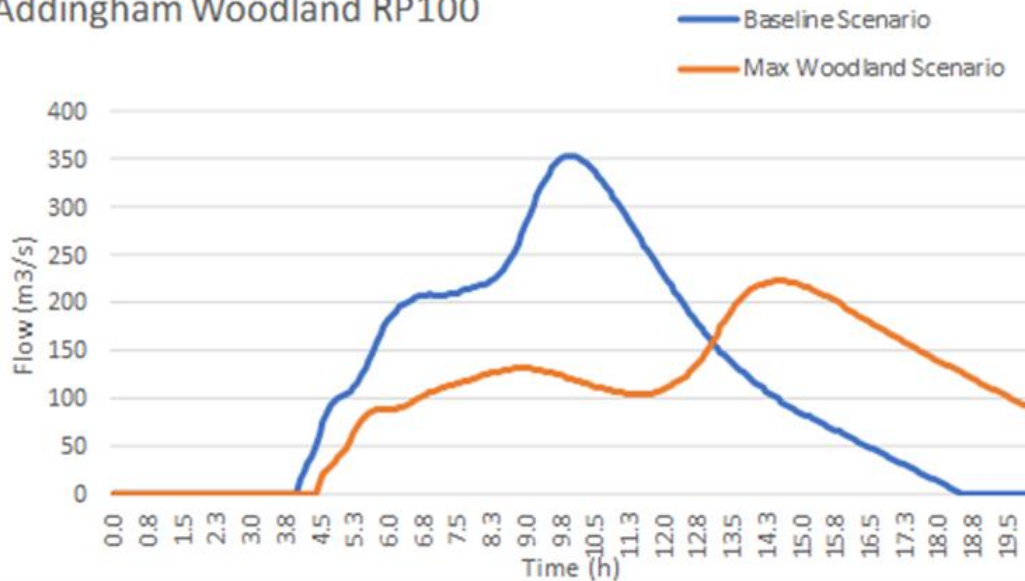
30 year scenario

	Flow monitoring cross-section	% reduction in peak flow	Model time of peak flow (hrs)	Model time to peak (mins)	Delay in time of peak (mins)
30 year					
Baseline	18	n/a	11.25	675	n/a
1. All RAFs	18	1%	11.25	675	0
2. Veg Buffers	18	3%	11.5	690	15
3. Soil Improvement	18	8%	11.5	700	15
4. NT/YDNPA Woodland	8 Kettlewell	2%	7.5	455	0
4. NT/YDNPA Woodland	18	1%	11.25	675	0
5. Additional NT/YDNPA Woodland	8 Kettlewell	8%	7.5	460	5
6. Woodlands for Water	18	38%	17	1025	350
7. Combination (4/rip trees/2/1)	18	8%	11.5	700	25



100 year scenario flow hydrographs

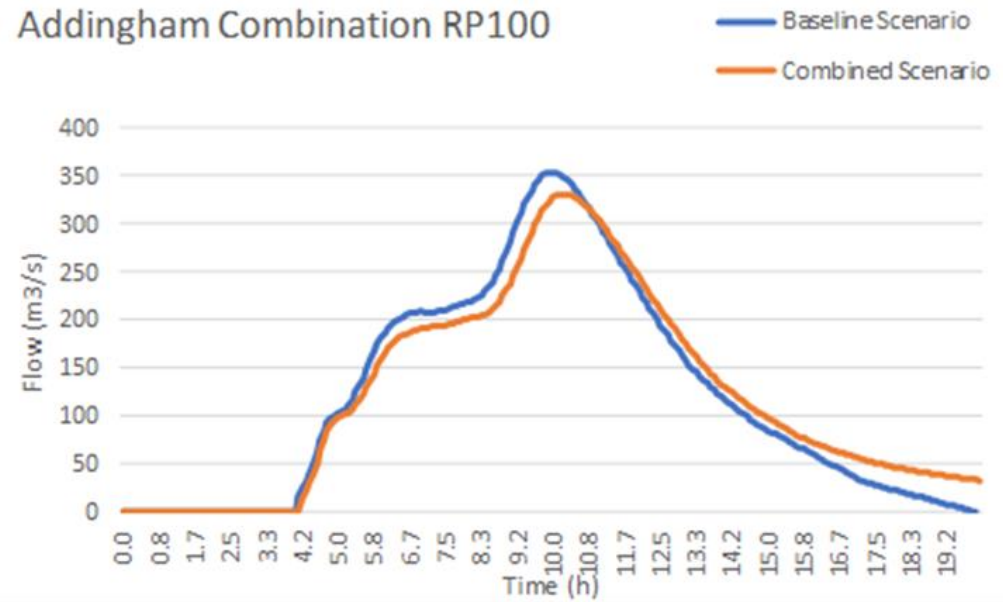
Addingham Woodland RP100



What maximum opportunity tree cover might be able to achieve across whole 400 sq km!!

Combination option - NT/YDNPA woodland planting, WfW riparian woodland, vegetated buffer strips, RAFs

Addingham Combination RP100



Outcomes

- Local FRM benefits at sub-catchment scale
- Only significant FRM benefits at catchment outlet when v.large increase in woodland cover (25%)
- Reasonable effect at catchment outlet when:
 - extensive improvement in soil structural condition (to 'improved' grasslands covering 1/3 of catchment)
 - Combination of NFM options
- Relatively unconstrained modelling
- Stakeholder engagement needed to determine more realistic/feasible/acceptable options





The End
Thanks for listening!!

