

Organic Producers Conference 2010  
Biodiversity and Ecosystem  
Services

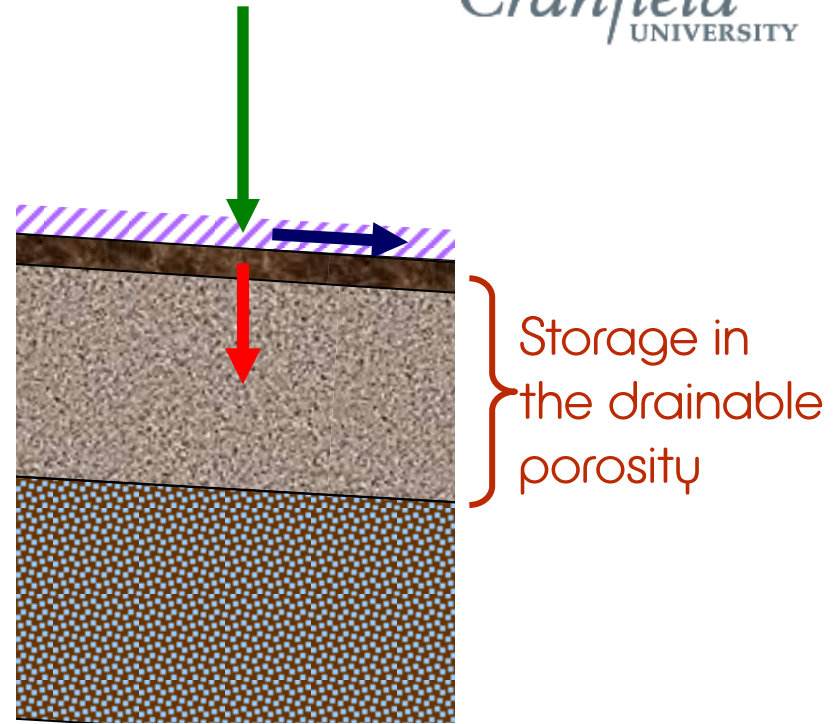
Management impacts on  
soil physical structure  
and infiltration rates  
Laura Hathaway-  
Jenkins



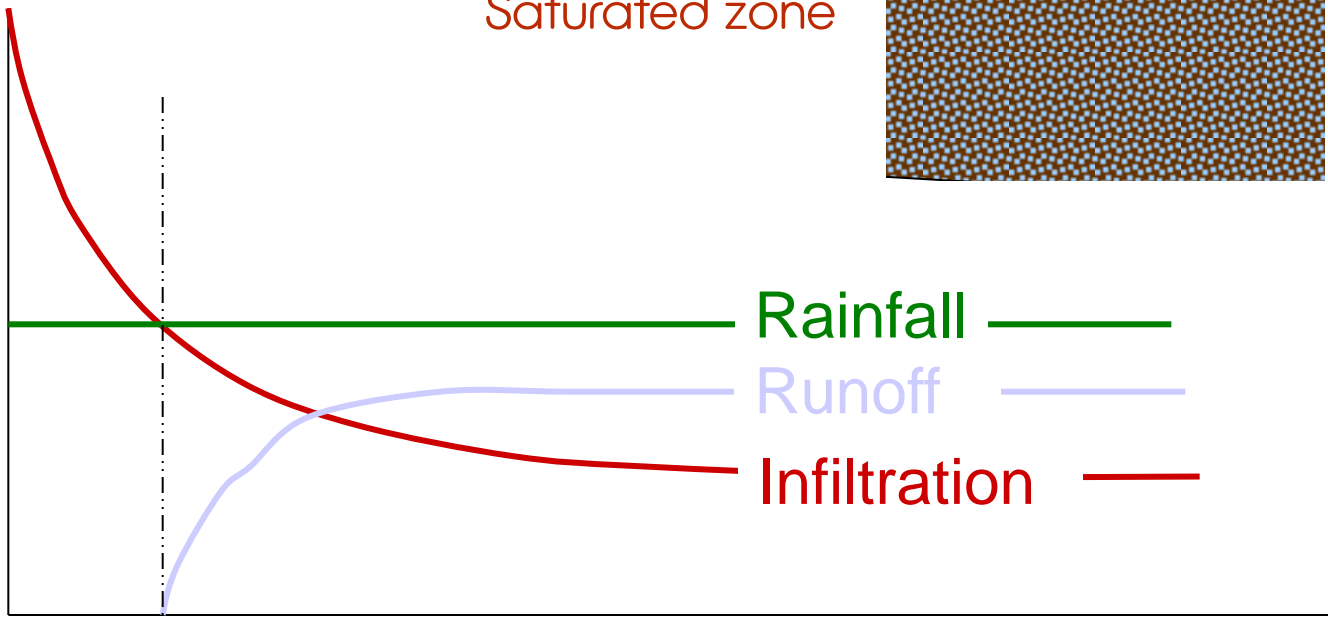
- An ecosystem service is defined as ‘the way the environment produces resources utilised by humans’ (Defra, 2009)
- Soil provides a medium to produce food and helps to regulate water flow
- Soil surface management in both arable and grassland farming is very important

# Rainfall, Infiltration, Storage and Runoff

Residue/cover  
Surface pan  
Non-saturated zone  
Saturated zone



Rate

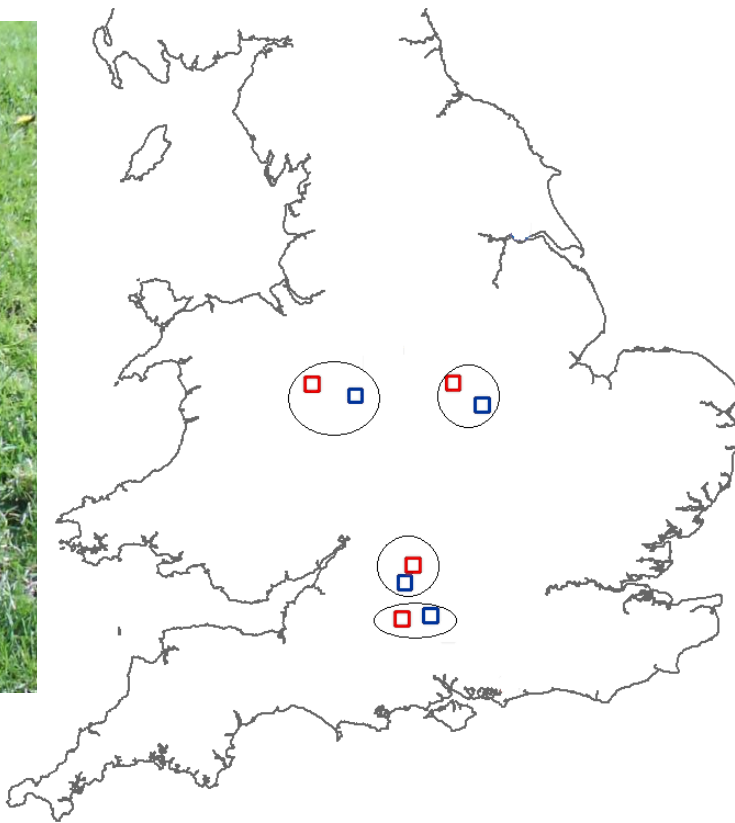


Rainfall

Runoff

Infiltration

Time



- Eight paired organic and conventional farms
- Four soil types: clay, clay loam, silty clay loam, sandy loam
- Two land uses: arable, grass

# Infiltration Rates (mmhr<sup>-1</sup>)

Treatment	Soil Texture (UK soil textural classification)			
	Clay	Clay Loam	Silty Clay Loam	Sandy Loam
Organic Grass	14.81	1.57	5.67	8.44
Organic Arable	13.42	2.36	4.18	3.64
Conventional Grass	6.38	1.16	0.78	1.80
Conventional Arable	4.87	0.77	6.79	16.20

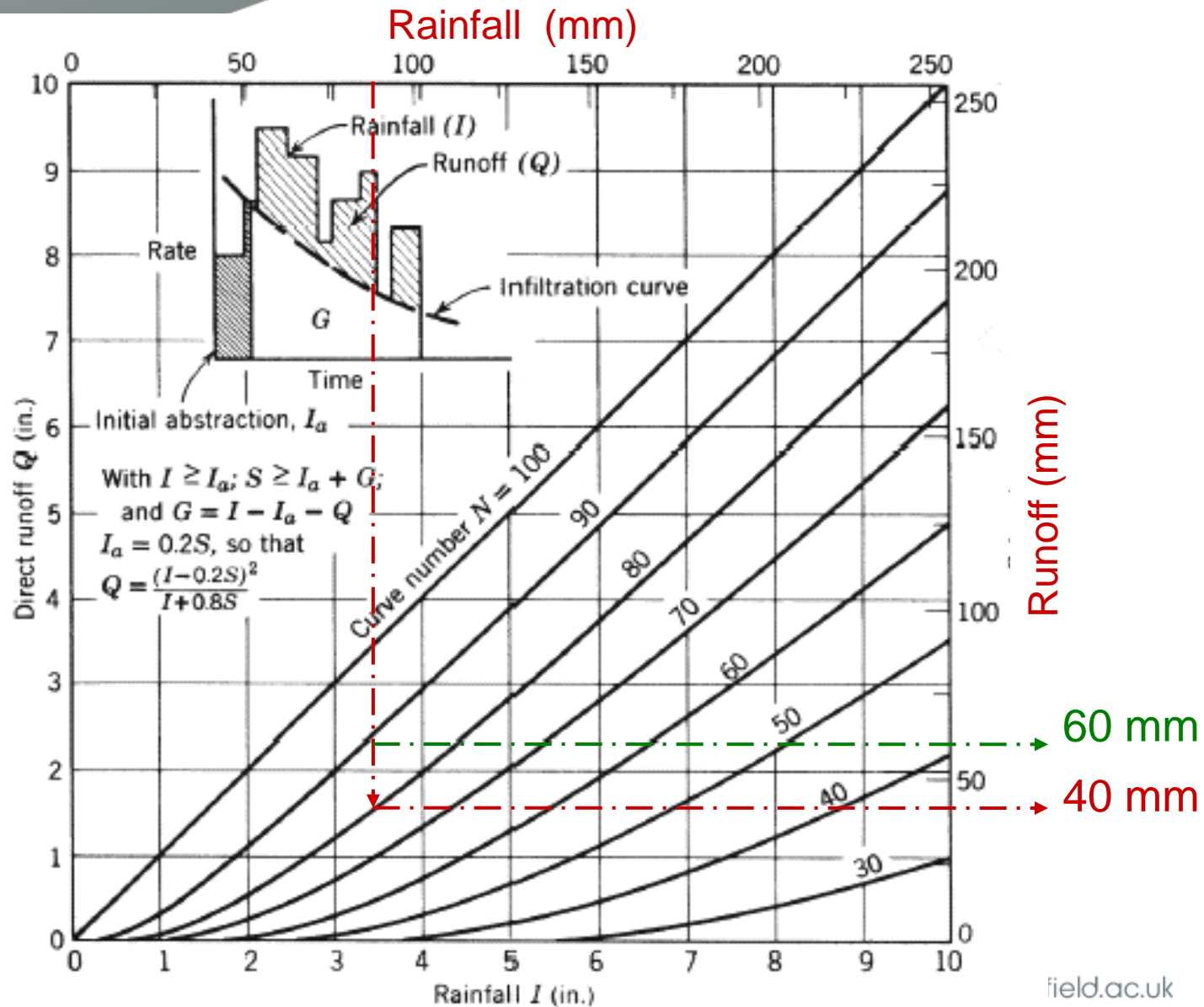
Soil Group	Description	Infiltration (mm h <sup>-1</sup> )
A	<b>Lowest Runoff Potential.</b> Includes deep sands with very little silt and clay, also deep, rapidly permeable loess.	8-12
B	<b>Moderately Low Runoff Potential.</b> Mostly sandy soils less deep than A, and loess less deep or less aggregated than A, but the group as a whole has above-average infiltration after thorough wetting.	4-8
C	<b>Moderately High Runoff Potential.</b> Comprises shallow soils and soils containing considerable clay and colloids, though less than those of group D. The group has below-average infiltration after pre-saturation.	1-4
D	<b>Highest Runoff Potential.</b> Includes mostly clays of high swelling percent, but the group also includes some shallow soils with nearly impermeable sub-horizons near the surface.	0-1

# USDA – Runoff Numbers (N)

## Hydrologic Soil Group

Land Use or crop	Treatment	Condition	Hydrologic Soil Group			
			A	B	C	D
Fallow	Straight row	-	77	86	91	94
<b>Row crops</b>	<b>Straight row</b>	<b>Poor</b>	<b>72</b>	<b>81</b>	<b>88</b>	<b>91</b>
	Contoured	Good	65	75	82	86
	Terraced	Good	62	71	78	81
Small grain	Straight row	Poor	65	76	84	88
	Straight row	Good	63	75	83	87
	Contoured	Poor	63	74	82	85
<b>Pasture or range</b>		<b>Poor</b>	<b>68</b>	<b>79</b>	<b>86</b>	<b>89</b>
		Fair	49	69	<b>79</b>	84
		Good	39	61	74	80
	Contoured	Poor	47	67	81	88
	Contoured	Fair	25	59	75	83
	Contoured	Good	6	35	70	79
<b>Meadow (permanent)</b>		<b>Good</b>	<b>30</b>	<b>58</b>	<b>71</b>	<b>78</b>
Woods (farm woodlots)		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	25	55	70	77

# Effect of Runoff curve number (N)



After: USDA, SCS (1972)



# Current soil conditions

Scenario	Good Practice runoff ( $\text{m}^3\text{s}^{-1}$ )	Poor Practice runoff ( $\text{m}^3\text{s}^{-1}$ )	Runoff ratio good / poor	Reduction in runoff (%)
Conventional	0.90	1.06	0.85	15.00
Organic	0.57	1.02	0.56	44.00

Under poor management there is little difference between organic and conventional dominated landscapes for the amount of runoff.

## Improved soil conditions

Scenario	Good Practice runoff ( $\text{m}^3\text{s}^{-1}$ )	Poor Practice runoff ( $\text{m}^3\text{s}^{-1}$ )	Runoff ratio good / poor	Reduction in runoff (%)
Conventional	0.22	0.46	0.48	42.00
Organic	0.15	0.44	0.34	66.00

Highlights the importance of good soil management even in improved soil conditions.

# Degraded soil conditions

Scenario	Good Practice runoff ( $\text{m}^3\text{s}^{-1}$ )	Poor Practice runoff ( $\text{m}^3\text{s}^{-1}$ ) <sup>1)</sup>	Runoff ratio good / poor	Reduction in runoff (%)
Conventional	1.55	1.54	1.00	0.00
Organic	1.44	1.56	0.93	7.00

There is little difference in good or poor practices under degraded conditions.

- Good soil management on all soil types is the key to improving infiltration rates and reducing runoff.
- There is little difference between landscape scenarios if the land is managed poorly.
- When good soil management practices are used there is a significant improvement when comparing organic and conventional landscapes.

Any Questions?

Thank you for listening.

