

9 *Appraisal of flood risk management for agriculture*

Figures and tables

Figure 9.1: Flooding and drainage factors influencing agricultural productivity on floodplain

Table 9.1: Tolerance of flooding according to agricultural land use

Table 9.2: Drainage conditions for agriculture and water levels in fields and ditches

Table 9.3: Common farming performance field drainage conditions (England and Wales)

Table 9.4: The Impacts of flooding on farm land vary according to type of agricultural land use and

Table 9.5: Indicative Financial and Economic Gross Margins and Net Margins for Selected Crop and Livestock Enterprises and Systems

Table 9.6: Defra advise that different assumptions are made for alternative agricultural flood defence scenarios

Table 9.7: Estimated cost of a single annual flood and indicative average annual damage flood costs by land use and drainage condition, all England

Figure 9.1 Flooding and drainage factors influencing agricultural productivity on floodplain

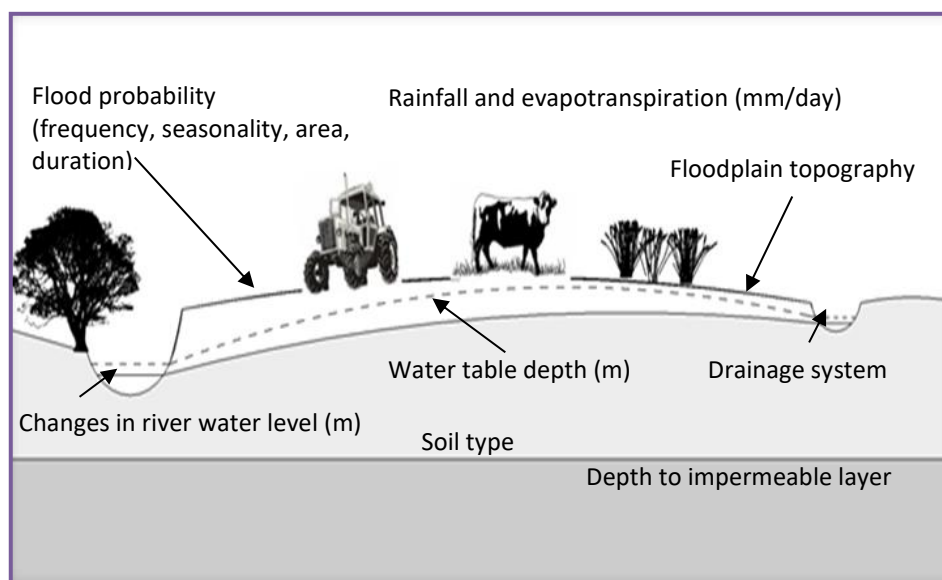


Table 9.1 Tolerance of flooding according to agricultural land use

Agricultural land use Type	Common minimum acceptable flood frequency: annual probability	
	Whole Year	Summer April-October
Horticulture	5%	1%
Intensive arable including sugar beet and potatoes	10%	4%
Extensive arable: cereals, beans, oil seeds	10%	10%
Intensive grass: improved grass, usually dairying	50%	20%
Extensive grass, usually cattle and sheep	≥100%	33%

Table 9.2 Drainage conditions for agriculture and water levels in fields and ditches

Agricultural drainage condition	Agricultural productivity class	Depth to water table from surface	Spring time freeboards in water-courses (natural drainage)	Spring time freeboards in water-course (field drains)
Good: 'rarely wet'	Normal, no impediment imposed by drainage	0.5 m or more	1 m sands,	1.2m clays to 1.6m sands (0.2m below pipe outfall)
			1.3 m peats	
			2.1 m clays	
Bad: 'occasionally wet'	Low, reduced yields, reduced field access and grazing season	0.3 m to 0.49 m	0.7 m sands	Temporarily submerged pipe outfalls
			1 m peats	
			1.9 m clays	
Very bad: 'commonly or permanently wet'	Very low, severe constraints on land use, much reduced yields, field access and grazing season: mainly wet grassland	Less than 0.3 m	0.4 m sands	Permanently submerged pipe outfalls
			0.6 m peats	
			1 m clays	

Table 9.3 Common farming performance field drainage conditions (England and Wales)

£ 2019 Values	Field Drainage Conditions		
	Good	Bad	Very Bad
Arable			
Yield as % of 'good' category			
Winter wheat and barley	100	80	50
Spring wheat and barley	100	90	80
Oil seed rape	100	90	80
Potatoes, Peas, Sugar Beet	100	60	40*
Typical wheat financial gross margin £/ha	£800-£900	£380-£480	£200-£300
Grassland			
Typical nitrogen use on grass kgN/ha	150 - 200	50 – 75	0 - 25
Grass conservation	2 cut silage	1 cut silage or graze	1 cut hay or graze
Typical stocking rates; Live-stock units/ha	1.7 - 2.0	1.2 - 1.4	0.7 - 1.0
Typical livestock type	Dairy, intensive beef and sheep	Beef cows, 24 month beef, sheep	Fattening of 'store' cattle, and sheep
Typical financial gross margins £/ha (after forage costs)	£1770-£1,970 (dairy) £500-£900 (intensive beef/sheep)	£390-£590	£190-£390
Days reduction in grazing season compared to 'good' category	none	Spring: 14 to 21 Autumn: 14 to 21	Spring: 28 to 42 Autumn: 28 , no stock out in winter

Notes:

Livestock units: dairy cow, 1 Lu; beef cow, 0.8 Lu; 24 month beef, 0.7 Lu; sheep plus lamb, 0.14 Lu.

A grazing day is worth about £2.2/Lu in spring, £1.6 /Lu in autumn, and £0.40/Lu in winter in terms of savings in housing costs and feed conservation costs. *not grown if persistently 'very bad'.

Table 9.4 *The Impacts of flooding on farm land vary according to type of agricultural land use and the seasonality of the flood event*

	Spring	Summer	Autumn	Winter
	March – May	June- August	September – November	December – February
Horticulture (soft fruits, salad crops)	Complete loss of soft fruits and winter /spring salads	Complete loss of annual production, possible loss of perennial stock	Loss of late season harvest, possible loss of perennial stock: replanting/reseeding	Damage to standing crops, annuals /perennials
Intensive Agriculture (including field vegetables & roots)	Delay in planting or loss of established crops	Likely complete loss of standing root crops eg potatoes/onions/carrots	Loss of unharvested autumn crops, notably potatoes. Delayed planting or loss of winter crops, substituted by spring sown crops	Possible loss of winter harvest crops (sprouts, and sugar beet). Yield loss on autumn sown crops
Extensive arable (cereals and oil seeds)	Loss or delay of spring sown cereals, yield loss on winter sown cereals, delayed spring treatments	Complete or partial loss of unharvested crops	Loss of unharvested autumn crops. Delayed planting or loss of winter crops, substituted by spring sown crops	Yield loss on autumn sown crops, reseeding with spring sown crops if severe damage
Grassland: intensive (mainly dairy)	Loss of grass yields, delayed stock turnout, delay fertiliser applications. Grass reseeding if long duration flooding	Loss of grass yields, partial or complete loss of hay/silage crop, loss of grazing, stock morbidity/mortality. Grass reseeding if long duration flooding	Loss of autumn grazing, stock relocation /housing. Possible reseeding if long duration.	Loss of winter 'accommodation' pasture.
Extensive (mainly beef and sheep)	Loss of grass yields, delayed stock turnout, delayed fertiliser applications.	Loss of grass yields, partial or complete loss of hay/silage crop, loss of grazing, stock morbidity/mortality.	Loss of autumn grazing, stock relocation /housing.	Limited impact on flood tolerant grass swards

NB. This is based on Table 9.4 in the MCM 2013

Table 9.5 Indicative Financial and Economic Gross Margins and Net Margins for Selected Crop and Livestock Enterprises and Systems

	£ 2019 values		Winter wheat ¹	Extensive arable ²	Intensive arable ³	Dairy cows ⁴	Beef & Sheep ⁵
Financial assessment							
<i>a</i>	<i>Gross Output</i>	£/ha	1355	1301	2581	3512	1343
<i>b</i>	<i>Variable Costs</i>	£/ha	481	449	996	1453	580
<i>c</i>	<i>Gross Margin (a - b)</i>	£/ha	874	852	1584	2059	763
	<i>Fixed Costs</i> ⁶						
<i>e</i>	<i>Semi-fixed Costs</i>	£/ha	251	245	371	533	276
<i>f</i>	<i>Total Fixed Costs</i>	£/ha	687	687	897	1403	747
Net Margin							
	<i>After semi fixed costs (c - e)</i>	£/ha	622	607	1214	1526	488
	<i>After full fixed costs (c - f)</i>	£/ha	187	166	687	656	17
Economic Assessment							
	Economic adjustment ⁷		None	Minor subsidy removal	High value crops treated as wheat	Dairy area treated as wheat ⁶	None
<i>g</i>	<i>Adjusted Gross Margin</i>	£/ha	874	852	874	874	763
	<i>Adjusted Net Margin</i>						
	<i>After semi fixed costs (g - e)</i>	£/ha	622	607	622	622	488
	<i>After full fixed costs (g - f)</i>	£/ha	187	166	187	187	17

Notes:

Some minor rounding errors

1 Assumes 9 t/ha

2 Assumes wheat 70%, oil seed rape, 20%, beans 10% by area.

3 Assumes wheat 66%, sugar beet 17%, potatoes and vegetables 17% y by area

4 Assumes dairy at 2 cows/ha stocking rate representing intensive grassland

5 Assumes beef suckler cows, beef fatstock and sheep in equal proportions by area, representative of extensive grassland

6 Land rent or land purchase costs are omitted from economic analysis

7 Dairy grassland area and high value crops are treated equivalent to a wheat crop

This is based on Table 9.9 in the MCM 2013, updated to 2019 prices (Defra, 2019)

2013 prices weighted by ratio of average of 2011-13 to average of 2017-2019 (2015=100)

Defra (2019) Agricultural Price Index. (published March 2019), <https://www.gov.uk/government/statistics/agricultural-price-indices>

Regional and local estimates vary according to circumstances and practices

Refer to Tables 9.8 and 9.9 in MCM 2013 (Penning-Rowsell *et al.*, 2013) for more detail.

Table 9.6 Defra advise that different assumptions are made for alternative agricultural flood defence scenarios*

	Scenario I	Scenario II	Scenario III
	Land lost to agriculture	Temporary, one-off loss of agricultural output	Permanent change in the value of agricultural output
All agricultural land use	Loss equivalent to market value of land less £600/ha to reflect 'single payment' subsidies where received (no adjustment on land for fruit and vegetables)		
Crops: Cereals; oilseeds; beans/peas. Grassland: Beef and sheep		Loss of Gross Margins per ha (adjusted for possible savings in costs), plus clean-up costs	Change in Net Margins associated with change in flood and land drainage conditions
Other: Dairy; sugar beet; potatoes; high value fruit/vegetables		As above, treated as though area occupied by wheat	As above, treated as though area occupied by wheat

* Following Defra Guidance, 2008 (See also Tables 9.4 and 9.5 above)

NB. This is Table 9.16 in the MCM 2013

Table 9.7 Estimated seasonally weighted cost of a single annual flood and indicative average annual damage flood costs by land use and drainage condition, all England and Wales monthly distribution of flooding (2019 prices)

	Drainage condition	Cost of a single annual flood £/ha	Indicative flood return period by land use, years	Average annual cost of flood damage according to indicative return period, £/ha
1. Extensive grass	Good	98	1	98
	Bad	79	0.75	105
	Very Bad	49	0.5	98
2. Intensive Grass	Good	177	3	59
	Bad	49	2	25
3. Grass/Cereal Rotation	Good	402	8	50
	Bad	311	5	62
4. All Cereal	Good	632	8	79
	Bad	451	5	90
5. Extensive Arable	Good	652	8	82
	Bad	480	5	96
6. Intensive Arable	Good	1154	10	115

Notes:

Some minor rounding errors

This is Table 9.20 in the MCM 2013