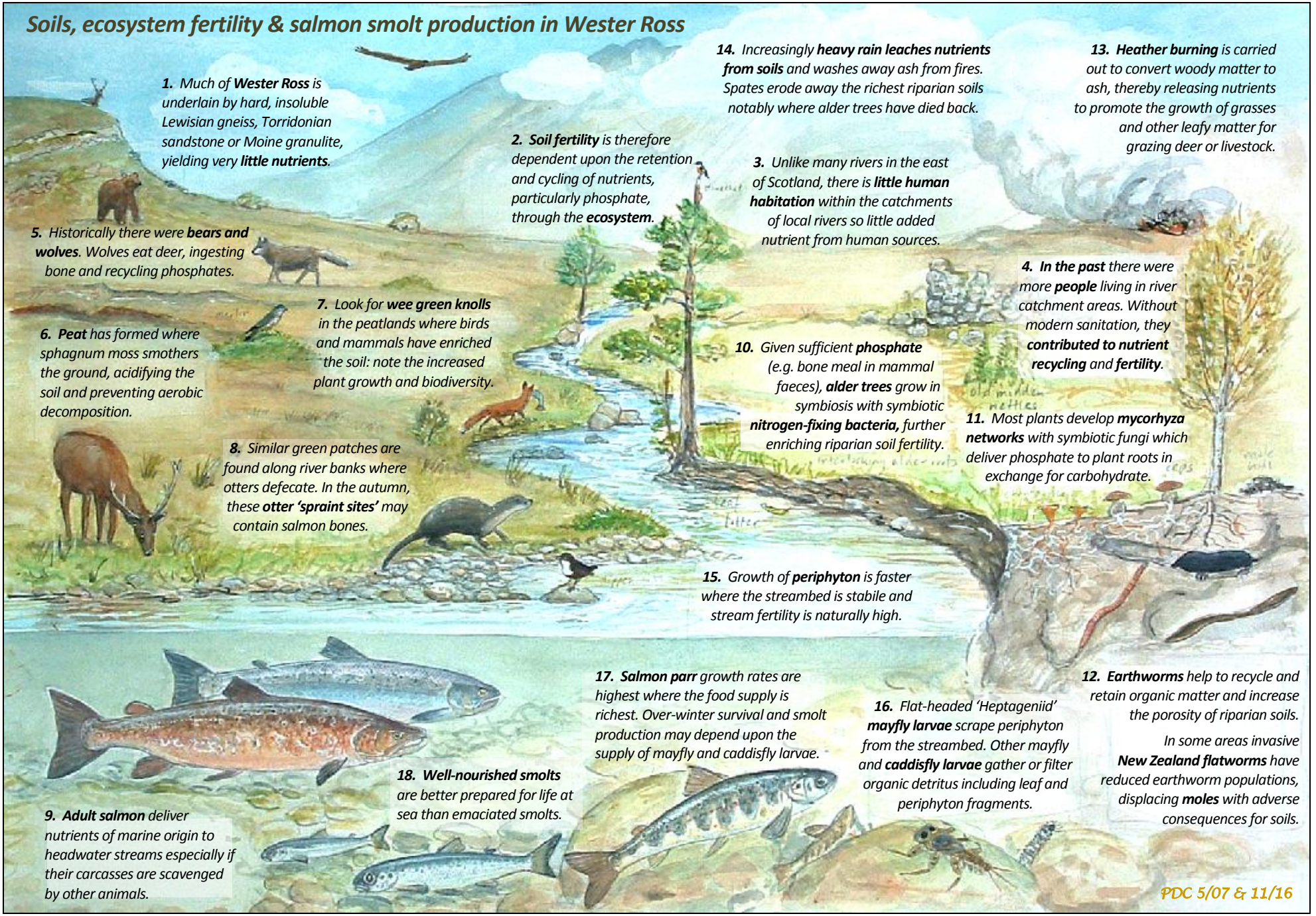
Soils, ecosystem fertility & salmon smolt production in Wester Ross



1. *Much of* ***Wester Ross*** *is underlain by hard, insoluble Lewisian gneiss, Torridonian sandstone or Moine granulite, yielding very* ***little nutrients****.*

2. Soil fertility *is therefore dependent upon the retention and cycling of nutrients, particularly phosphate, through the* ***ecosystem****.*

3. *Unlike many rivers in the east of Scotland, there is* ***little human habitation*** *within the catchments of local rivers so little added nutrient from human sources.*

4. In the past *there were more* ***people*** *living in river catchment areas. Without modern sanitation, they* ***contributed to nutrient recycling*** *and* ***fertility****.*

5. *Historically there were* ***bears and wolves****. Wolves eat deer, ingesting bone and recycling phosphates.*

6. Peat *has formed where sphagnum moss smothers the ground, acidifying the soil and preventing aerobic decomposition.*

7. *Look for* ***wee green knolls*** *in the peatlands where birds and mammals have enriched the soil: note the increased plant growth and biodiversity.*

8. *Similar green patches are found along river banks where otters defecate. In the autumn, these* ***otter 'spraint sites'*** *may contain salmon bones.*

9. Adult salmon *deliver nutrients of marine origin to headwater streams especially if their carcasses are scavenged by other animals.*

10. *Given sufficient* ***phosphate*** *(e.g. bone meal in mammal faeces),* ***alder trees*** *grow in symbiosis with symbiotic* ***nitrogen-fixing bacteria,*** *further enriching riparian soil fertility.*

11. *Most plants develop* ***mycorhyza networks*** *with symbiotic fungi which deliver phosphate to plant roots in exchange for carbohydrate.*

12. Earthworms *help to recycle and retain organic matter and increase the porosity of riparian soils.*

In some areas invasive ***New Zealand flatworms*** *have reduced earthworm populations, displacing* ***moles*** *with adverse consequences for soils.*

13. Heather burning *is carried out to convert woody matter to ash, thereby releasing nutrients to promote the growth of grasses and other leafy matter for grazing deer or livestock.*

14. *Increasingly* ***heavy rain leaches nutrients from soils*** *and washes away ash from fires. Spates erode away the richest riparian soils notably where alder trees have died back.*

15. *Growth of* ***periphyton*** *is faster where the streambed is stabile and stream fertility is naturally high.*

16. *Flat-headed 'Heptageniid'* ***mayfly larvae*** *scrape periphyton from the streambed. Other mayfly and* ***caddisfly larvae*** *gather or filter organic detritus including leaf and periphyton fragments.*

17. Salmon parr *growth rates are highest where the food supply is richest. Over-winter survival and smolt production may depend upon the supply of mayfly and caddisfly larvae.*

18. Well-nourished smolts *are better prepared for life at sea than emaciated smolts.*

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