

Flood = Drought



**Our great misunderstanding with water.
Problems with water resources are global
... and so are the solutions**



**But usually the causes are
misunderstood**

Sustainability

“an issue of great confusion”

County Council Environment Report (Draft)

Ecological processes are complex ...

... and poorly understood

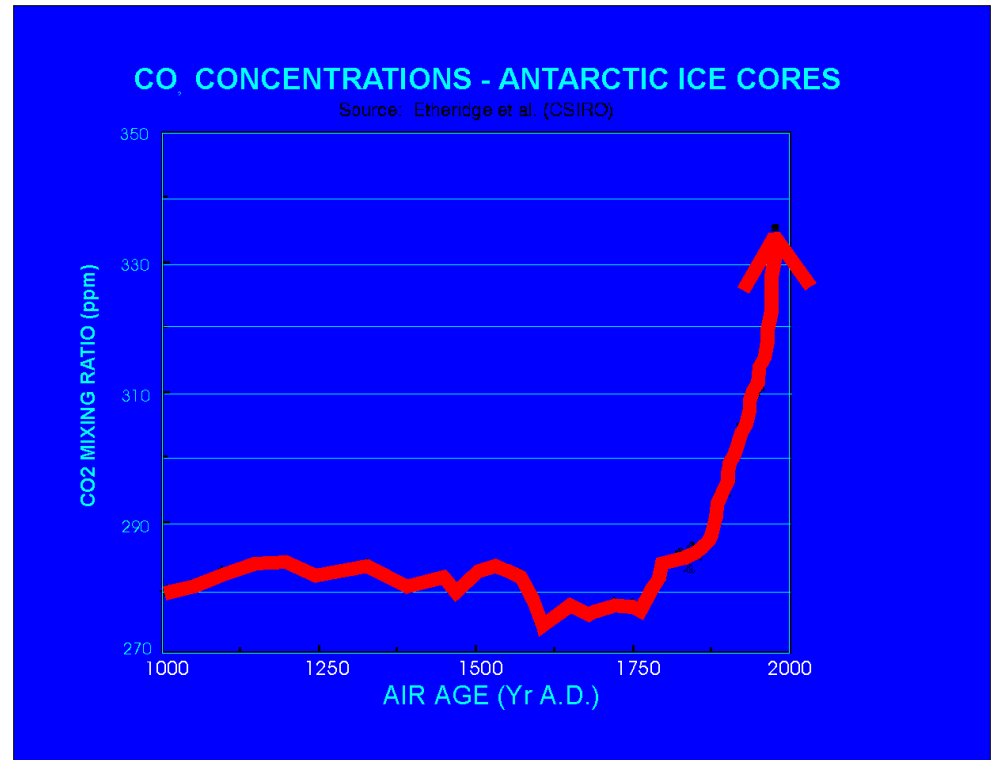
Resource and pollution debts

Precautionary approach

Water (public health, flood & drought) = finite focus for sustainability*

AND URGENT ACTION !

*Art. 32 Water Framework Directive



Drought and floods 'may become a way of life'

TOWNS swamped by floods just months ago could suffer deluges each winter and droughts each summer, the Environment Agency says.

A spokesman said parts of the South-East could see a regular pattern of floods every winter and droughts every summer because of extreme weather patterns.

She said: "Climate change is believed to be the cause of these seemingly contradictory circumstances and the agency is gravely concerned that flooding will once again cause devastation this winter."

"We have this very strange set of circumstances in which people are still cleaning up after the floods while we are having to top up rivers.

"It is a serious concern that we could have floods each winter and water shortages in the summer."

The Daily Telegraph 12/07/2001

Can 'climate change' really be the cause of floods and droughts in a single year ?

That just 'may become a way of life' ...

... this is a very strange set of circumstances.

“It is quite strange that despite the torrential rains in some parts of Ghana, which is causing severe flooding and destruction of properties, these and other areas are simultaneously engulfed with water scarcity problems. This is very common in the three most arid regions of the country – Northern, Upper East and Upper West.”

Ismaila Emahi, Water21, 16 June 2008

**These ‘strange’ problems appear to becoming
rather universal**

Daily Graphic, Friday, May 16, 2008.

Water shortage hits Yendi Municipality

Story: Zakaria Alhassan, Yendi

ECONOMIC and social activities in the Yendi Municipality have suffered a serious setback following an acute water shortage that has hit the area for some weeks now.

The only source of potable water for the area, River Dakar (White Volta), also known as Kulekpeni, has virtually dried up compelling the people to travel long distances in search of potable water.

The education sector has suffered most as pupils and students have to wake up early in the morning to search for water for use before attending classes.

It is for this reason that residents have passionately appealed to the government and other philanthropic organisations to come to their aid to ameliorate their current diffi-

culties.

As an interim measure, the Northern Regional Co-ordinating Council (RCC), in collaboration with the Ghana Water Company Limited (GWCL), despatched eight water tankers from Tamale to the municipality on Wednesday to serve the people.

The Northern Regional Co-ordinator of the National Disaster Management Organisation, Mr Alhassan Mahmoud, on behalf of the Regional Minister, Alhaji Mustapha Ali Idris, led a group which included the Regional Manager of the GWCL, Mr Samuel Mensah.

The tankers were mobilised from the GWCL, the Prisons Service, Customs, Excise and Preventive Service (CEPS) and Zoomlion Ghana Limited, a waste management organisation.

Mr Mensah gave the assur-

ance that his outfit would strive to sustain the supplies until the situation was brought under control.

The Municipal Chief Executive, Alhaji Mohammed Habib Tijani, said if measures were not taken to address the situation, there could be an epidemic.

He said the municipality was vast and that more tankers were needed to extend their services to the rural communities.

Alhaji Tijani further stated that most people had resorted to drinking contaminated water, a situation that could result in the emergence of guinea worm and other water-borne diseases.

He, however, stressed the need for the people to protect the water source by planting trees and also desisting from farming and engaging in other activities around the water banks to prevent the river from further drying up in future.



Pictura: TIM DZAMBOE

Flood victims in NR get assistance

The Volta Regional Chairman of the Ghana National Tailors and Dress-makers Association (GNTDA), Mr Nicholson Nanevi (left), in a handshake with the acting Regional Co-ordinator of the National Disaster Management Organisation (NADMO) to hand over the second-hand clothes to the flood victims in the

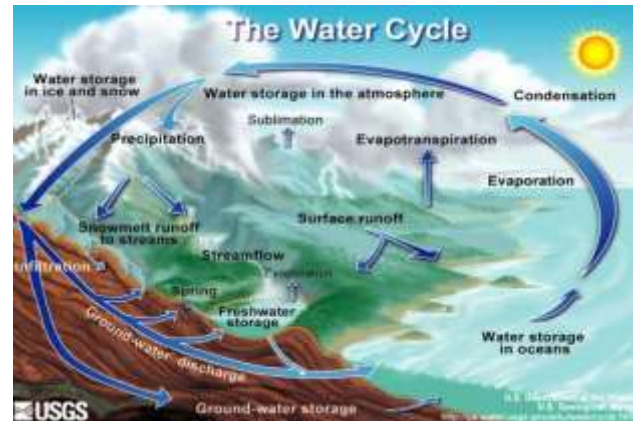
Northern Region. Looking on are some zonal officers of NADMO and some executives of the GNTDA.

The Volta Regional branch of the GNTDA presented the six bales of second hand clothes worth GHc500 to the flood victims in the Northern Region as a humanitarian gesture to the victims to alleviate their problem.

the patients at home. She advised mothers to vaccinate their

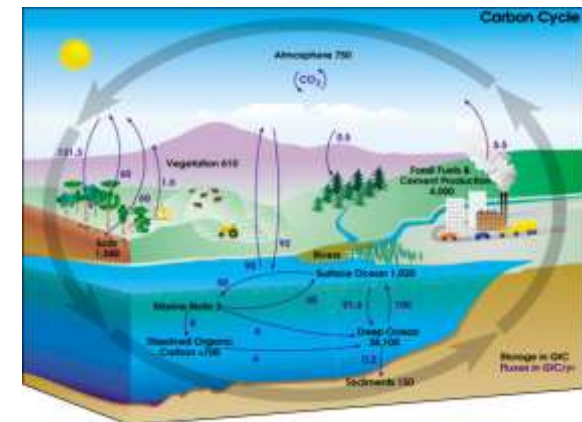
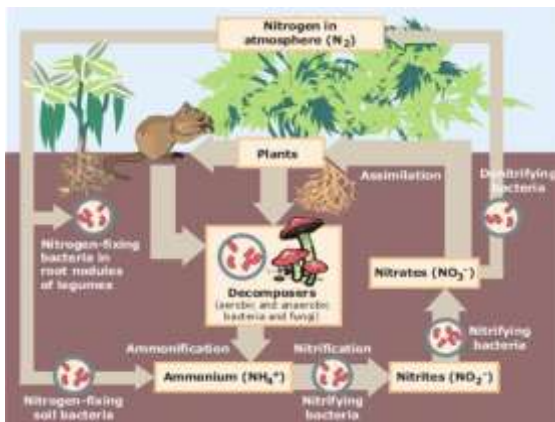
Just as seen in UK – floods and drought afflicting the very same areas.

Water Cycle



We are part of nature and must integrate our actions

Nitrogen Cycle *with natural cycles* **Carbon Cycle**



Flood related problems – Stroud Valleys

Climate change

Erosion of land and siltation problems

Degraded farmland needing fossil-fuel based inputs

Depletion of aquifers – drought prone

Sewage spills

Pollution of water courses, possible public health risk

Loss of habitat and biodiversity

Rising costs of living – worsening global recession

No effective plan to resolve flooding (estimated £1million spent since 2007 on flawed or even reckless flood planning in Frome Catchment)

Flood lessons 'must be learned'

Lessons must be learned from the floods, Prime Minister Gordon Brown has said, after severe weather caused chaos across parts of England and Wales.

The prime minister said the flooding had been "an emergency that no-one could have predicted"

BBC News 21 July 2007



Stroud, 2007
courtesy Zara Davis

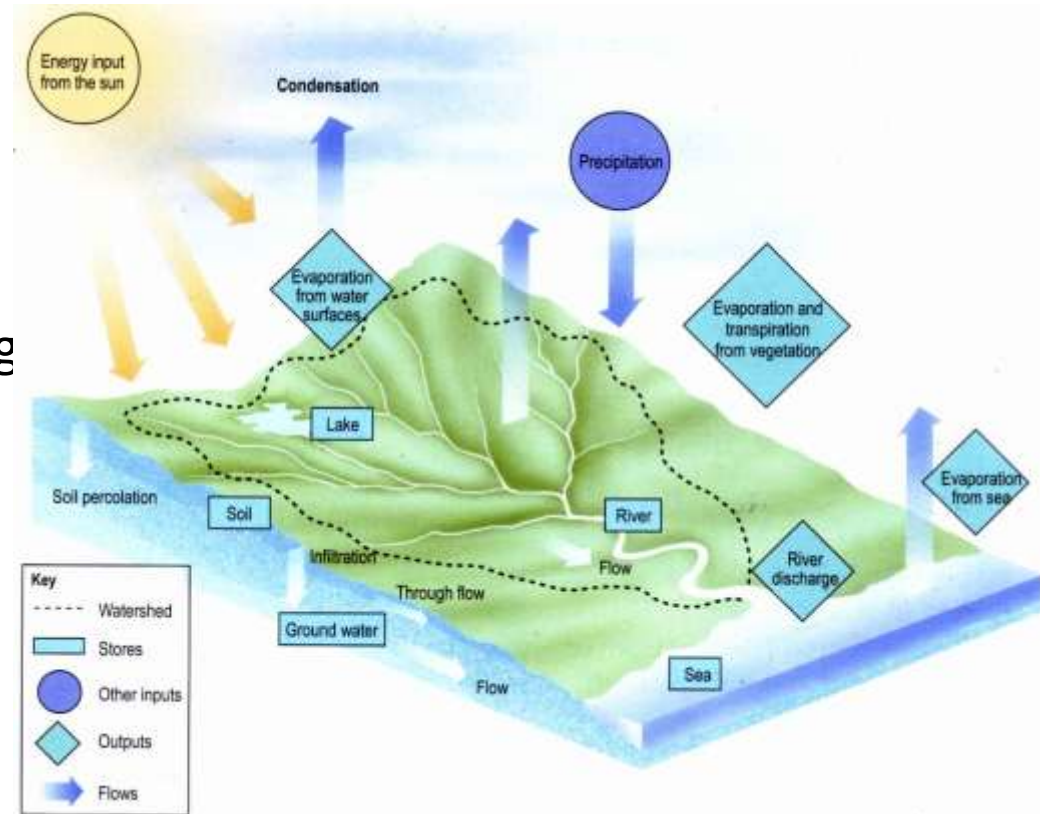
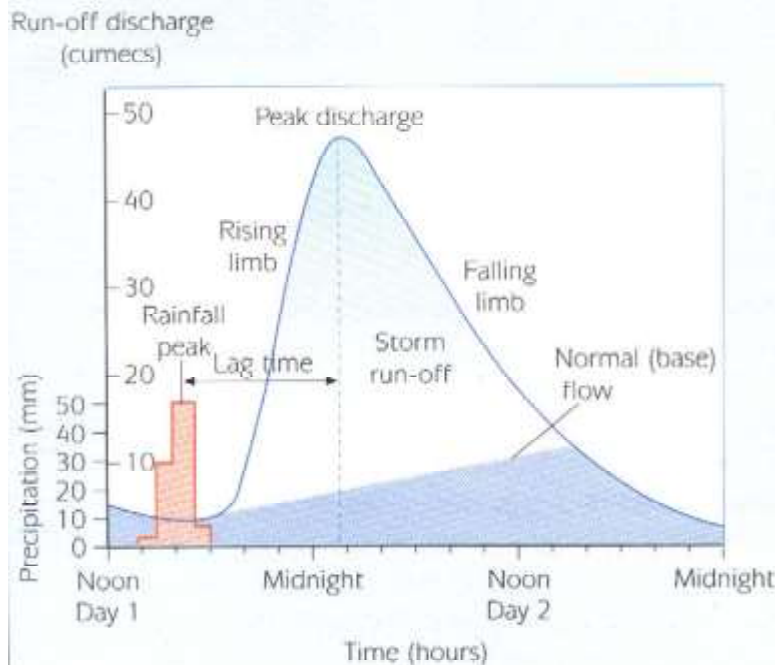
**Those 'lessons'
we must learn ... ?**

Floods = Droughts

Caused by –

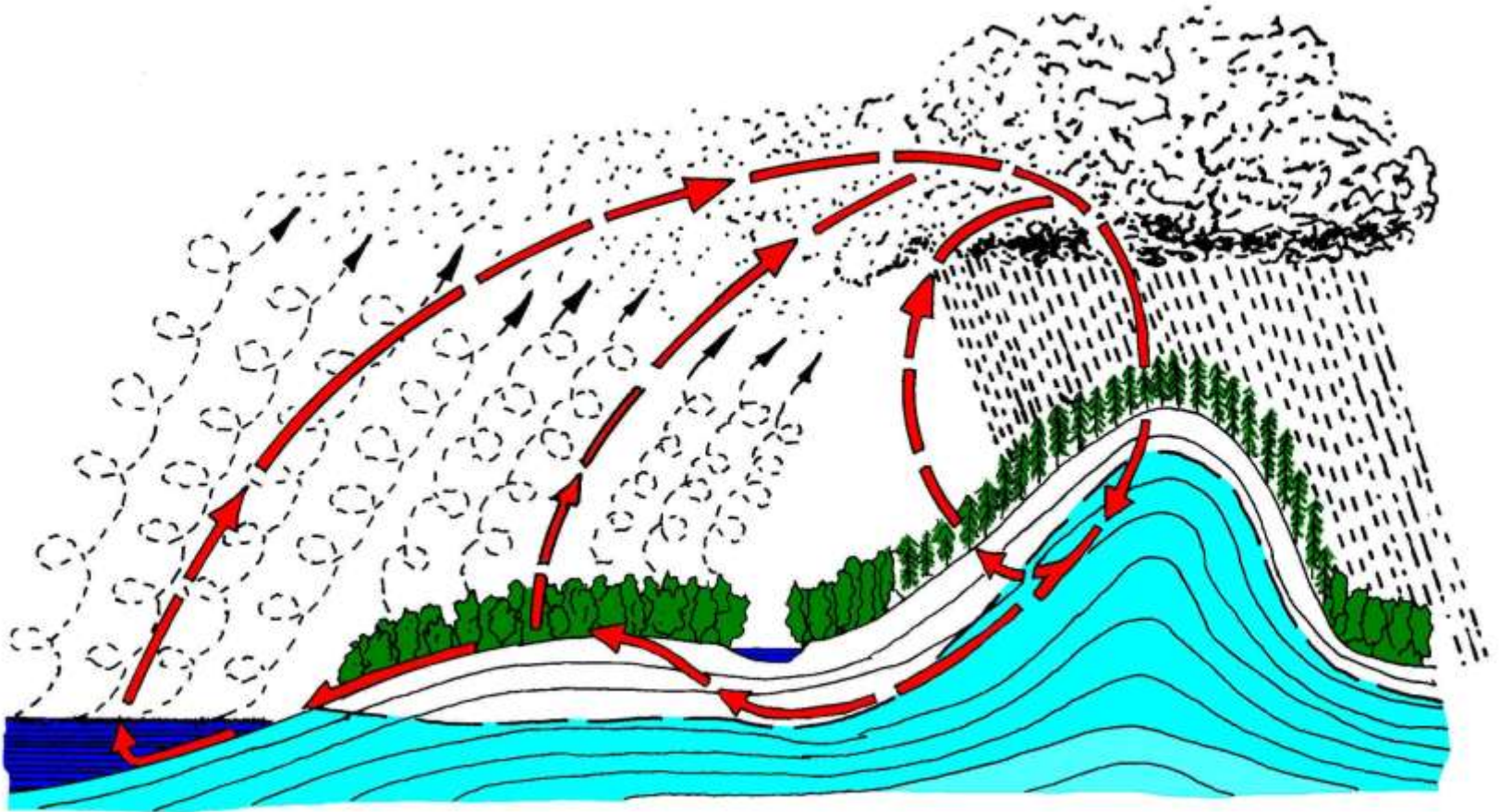
Extremes in **rainfall** amplified by human **disruption** of the natural **hydrological cycle (ecology)**.

A 'student' level of understanding
yet all largely ignored.



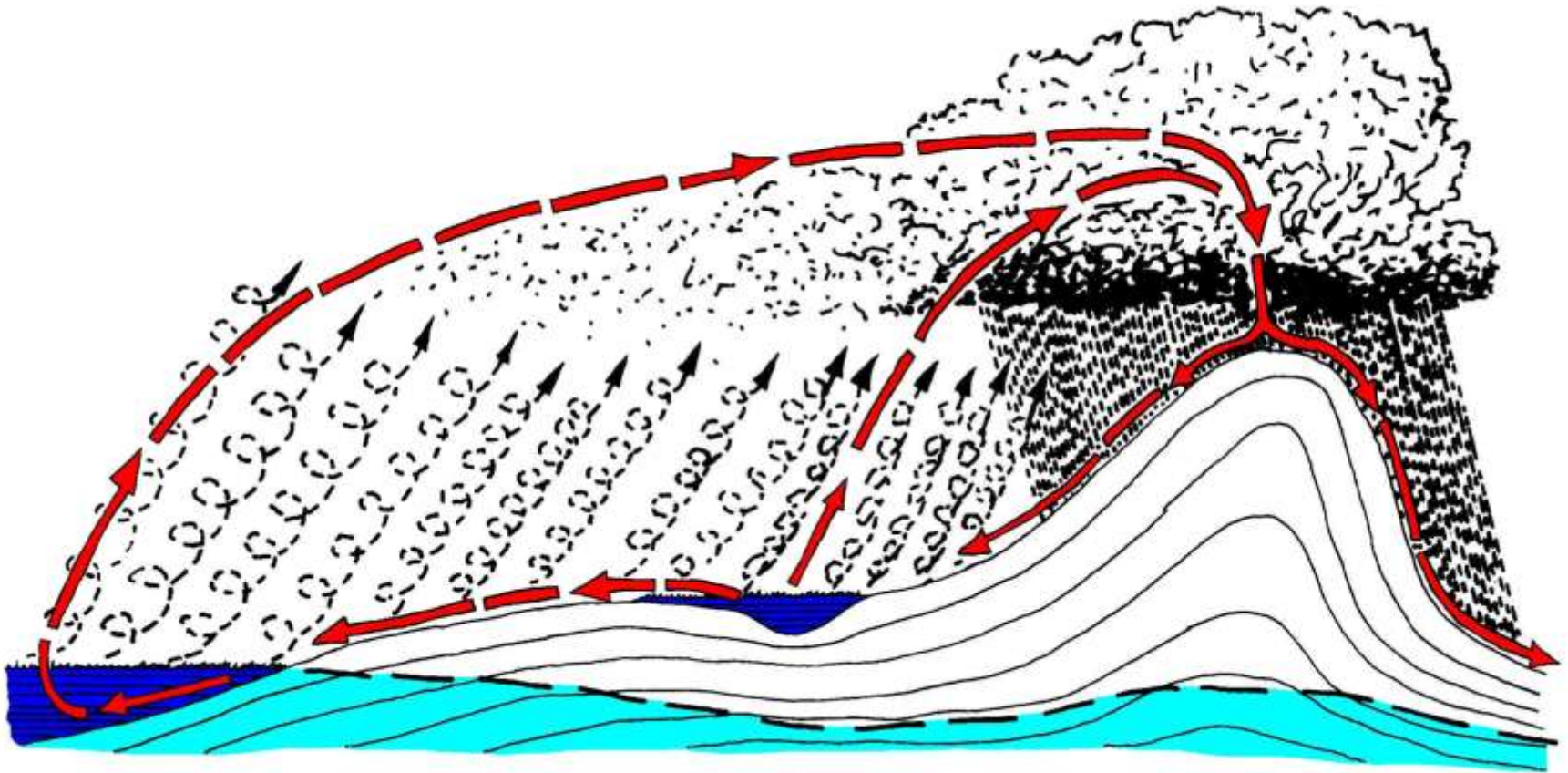
Built environment & chemical agriculture
*Degraded landscapes are the biggest
cause of flood & drought*

The 'Full' Hydrological Cycle



Functioning ecology : 'Balanced' rainfall, steady evapo-transpiration, good infiltration to water table

Our 'Half' Hydrological Cycle



Disrupted ecology and degraded landscapes: causes rainfall 'extremes', rapid evapo-transpiration, flooding, poor infiltration to (falling) water table – and 'drought'

Trees hold answer to floods menace

Scientists have discovered that simple strips of newly planted woodland could play a crucial role in halting the floods that have devastated British towns in recent years.

They found that land with trees can hold vast amounts of water that would otherwise stream down hills and surge along rivers into towns.

'The extent of water absorption was entirely unexpected,' said Dr Zoe Carroll of the Centre for Ecology and Hydrology in Bangor. 'It also has great potential for helping us deal with floods.' Scientists at the centre collaborated with farmers from Pontbren, a community in the North Powys hills.

'We measured rain that was being absorbed by grazing land and by woodland, and found the latter was **60 times more effective at taking up water than soil** on land grazed by animals,' said Carroll. 'We expected to find a difference, but not one of this magnitude.'

The team do not fully understand the reasons for this, though grazed land tends to be compacted by hooves and this could reduce its capacity to let in rain. Trees also generate roots that break up soil, creating pathways for water to move through.

A £6m research programme is now investigating Britain's flood problem and will focus on Pontbren.

Sunday September 26, 2004

The Observer

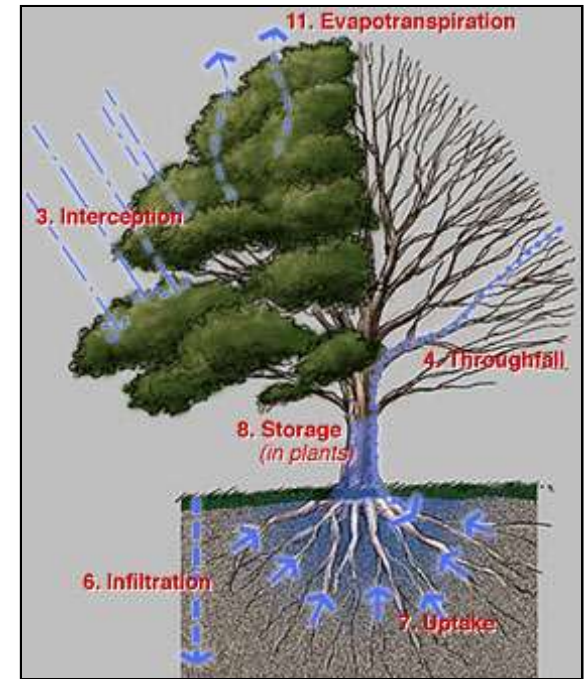
Landscapes - Key 'Climate Modifiers & Regulators'

Implications for Agriculture, farmers are 'guardians' of major aquifer recharge processes.

- 50+ years of chemical farming & drainage.
- Severely disrupted water cycle.
- Major cause of flood & drought

Trees are also important moderators of temperature and 'organs of water renewal'.

- They intercept, capture and infiltrate rainfall, draw up groundwater. They create rainfall through evapo-transpiration, and 'seeding' (nucleation) of raindrops via pollens & terpenes. Thermal benefits.



Wetlands provide similar benefits (Water Quantitative & Qualitative).

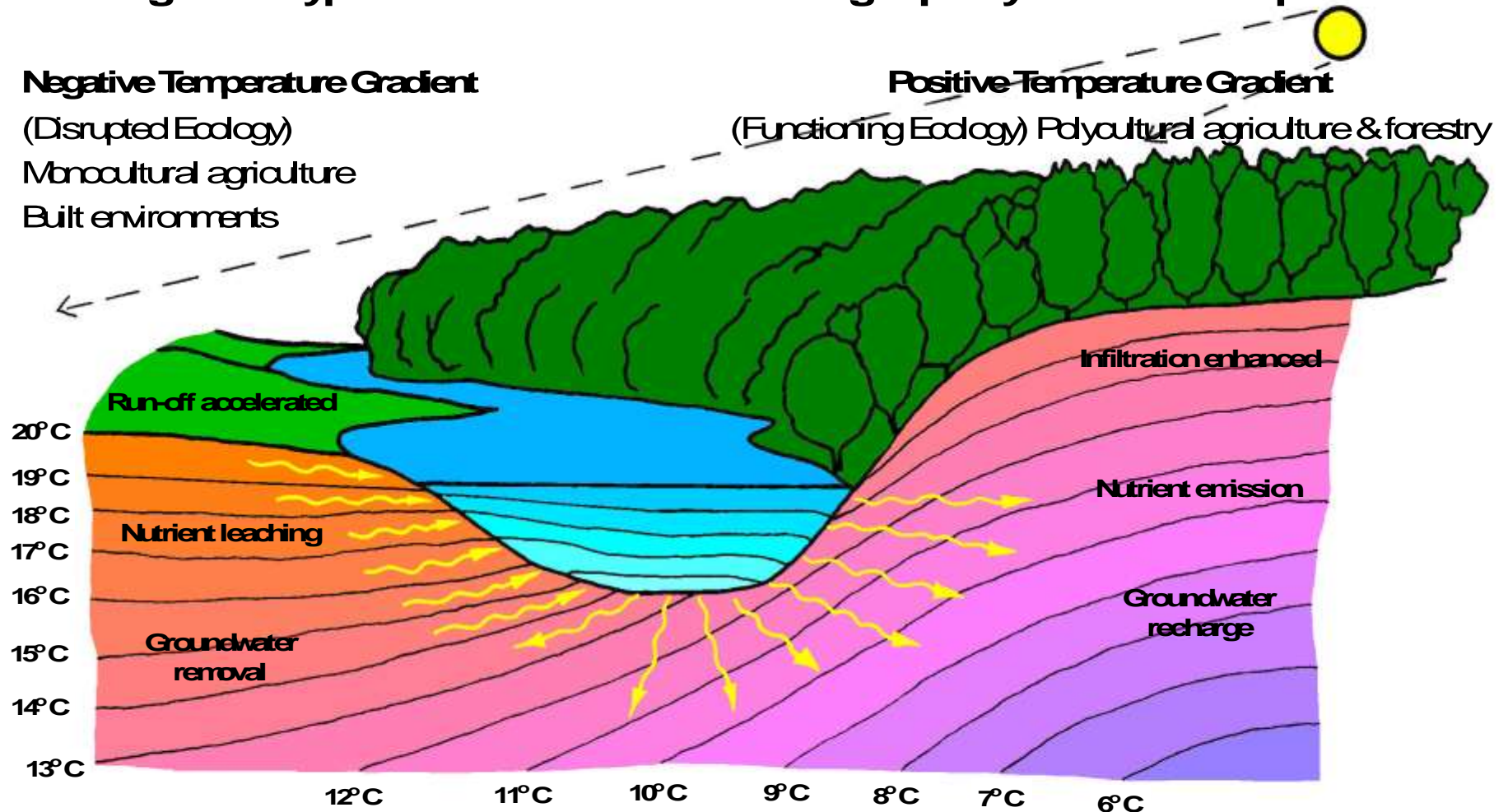
- Pre-human intervention – 25% UK land area comprised wetlands, now less than 2%. Return to extensive wetlands essential for WFD.

Important agents of climate & weather change operate at a micro-/sub microscopic level (bacteria [in clouds and soil], algae, plankton, solar wind & cosmic ray interactions, etc).

The ecosystem is the main 'engine' of weather & climate – 'orchestrated & powered' by solar activity.

Effects of temperature gradient on run-off & infiltration

Solar activity (thermal & solar particle effects) influences run-off & infiltration through sub-surface temperature gradient and it's effects on micro & macro flora/fauna activity according to soil type & humus content determining capillary action and evaporation.



Those lessons to learn ...

- Retention (attenuation)
 - Enhance infiltration
 - Reduce evaporation

... with (multi) functional water,
food & energy landscapes

Farming 'crimes'... against the water cycle



Arable field, Painswick. 30cm of topsoil lost in 50 years of arable farming (effects of tillage & chemicals) - agricultural soil degradation (capillary action) typically comprises the biggest single cause of flood & drought in any river catchment, also severely degrading watercourse biodiversity here.

Good ecological status for watercourses can only be met with legitimate farming methods – long term.



A (micro)biological understanding of soil function



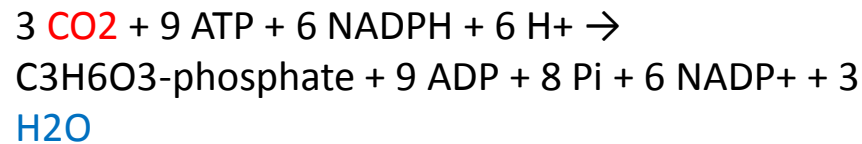
Tillage and agrochemicals kill carbon sequestering soil microbiology, limiting rain infiltration.

Historic and ongoing releases of soil carbon to the atmosphere exceed that from burning fossil fuels.

Biological monoculture farming enables carbon sequestration, water resource (flood & drought) benefits.
- A long term transition for farmers.



Light-independent photosynthesis by soil bacteria :



(The Calvin Cycle – an endothermic, cooling reaction that stores carbon (humus) & creates water).

Stroud Valleys Soil Erosion Map

Key Findings

- Erosion risk map indicates high erosion rates in Stroud Valleys, with hotspots in Painswick and Ruscombe catchments. This strengthens the rationale to tackle the sediment problem.
- High proportion of silt in most samples indicates erosion occurring in catchment.
- Soil analysis to determine viability of silt re-use as a soil improver:
 - High organic carbon content (improves soil structure and moisture retention).
 - High silt content in most sites (clay would reduce infiltration, sand wouldn't retain nutrient).
 - Phosphate and Nitrogen content variable: 3-45% that of artificial fertilisers.
 - Some nutrient hotspots in Ruscombe and Painswick valued at ~£100/t.
 - Analysis indicated one site that cannot be used for silt reuse due to high levels of Zinc.

The evidence supports the anecdotal claims that silt is beneficial as a soil improver for agriculture.

River Site	Ruscombe Brook		Painswick Stream		Slad Brook		River Toadsmoor	
	P ₂ O ₅	N	P ₂ O ₅	N	P ₂ O ₅	N	P ₂ O ₅	N
1	£95.41	£60.32	£29.74	£18.91	£35.41	£57.07	£21.33	£18.54
2	£39.91	£20.80	£31.12	£54.35	£91.95	£31.66	£28.53	£19.14
3	£49.50	£33.92	£45.73	£103.08	£24.34	£22.64	£48.04	£70.85
4	£40.27	£17.27	£34.32	£25.79	£32.83	£21.97	£41.76	£42.03
5			£39.11	£32.10	£31.57	£40.49	£23.45	£24.50

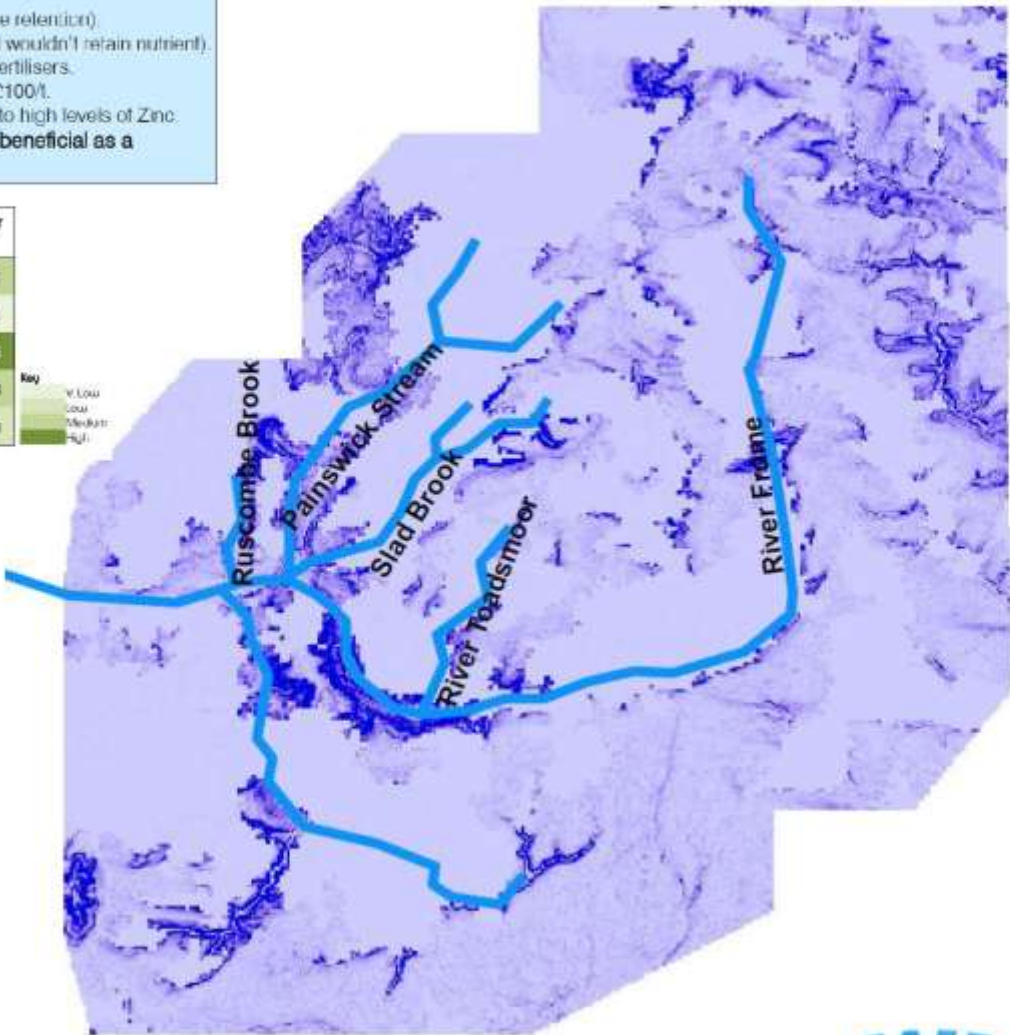
Key
 V. Low
 Low
 Medium
 High

Recommendations

- Conducting comparative field trials of river silt, farmyard manure and fertiliser application to agricultural land to show impacts on soil health and crop/grass production.
- Integrate soil transport models with Erosion Risk Map to estimate availability of silt resources.
- Determine economic costs of capture and reuse at local scale.
- Investigate environmental costs of silt extraction.



Kat Gorham
 Water 21



Legend

Frame River System

USLE

Value

High : 69.0163
 Low : 0

Benefits of impoundments



Online heritage millpond (above) in Stroud Valleys, Frampton Mansell, demonstrating biodiversity and lost opportunity for both renewable energy (hydropower) and active control for flood risk.

Small online pond (right), Washbrook, Painswick, enables capture & recovery of valuable humus & nutrient, (topsoil and manure); here as accumulated silt, which refills in few months after cleaning out.

Impoundments are essential to create 'online & offline' wetlands for WFD fulfilment. They enable :

- Control of critical flood risk (drought moderating)
- Biodiversity benefit through hydrologic function.
- Economic benefit, hydropower, irrigation, fisheries, silt recovery, etc.
- Short term resolution of farming problems while long term land management addressed.



Benefits of impoundments



Drought prospects for summer
2011

Report – GEH00611BTYP-E-E

The Water Framework Directive (WFD) is a major opportunity to improve the whole water environment and promote the sustainable use of water for the benefit of people and wildlife.

... by introducing a holistic approach to water management ... contribute to mitigating the effects of floods and droughts – **Environment Agency**

Environment Agency urges farmers and water companies to act now in response to drought

Action should be taken now to protect water supplies for business, agriculture, the environment and people - thereby minimising the risk of water restrictions in the future, says a new report from the Environment Agency.

It recommends that **more farmers should invest in winter storage** and that water companies plan ahead for more long, dry periods and continue running campaigns to encourage customers to reduce water.

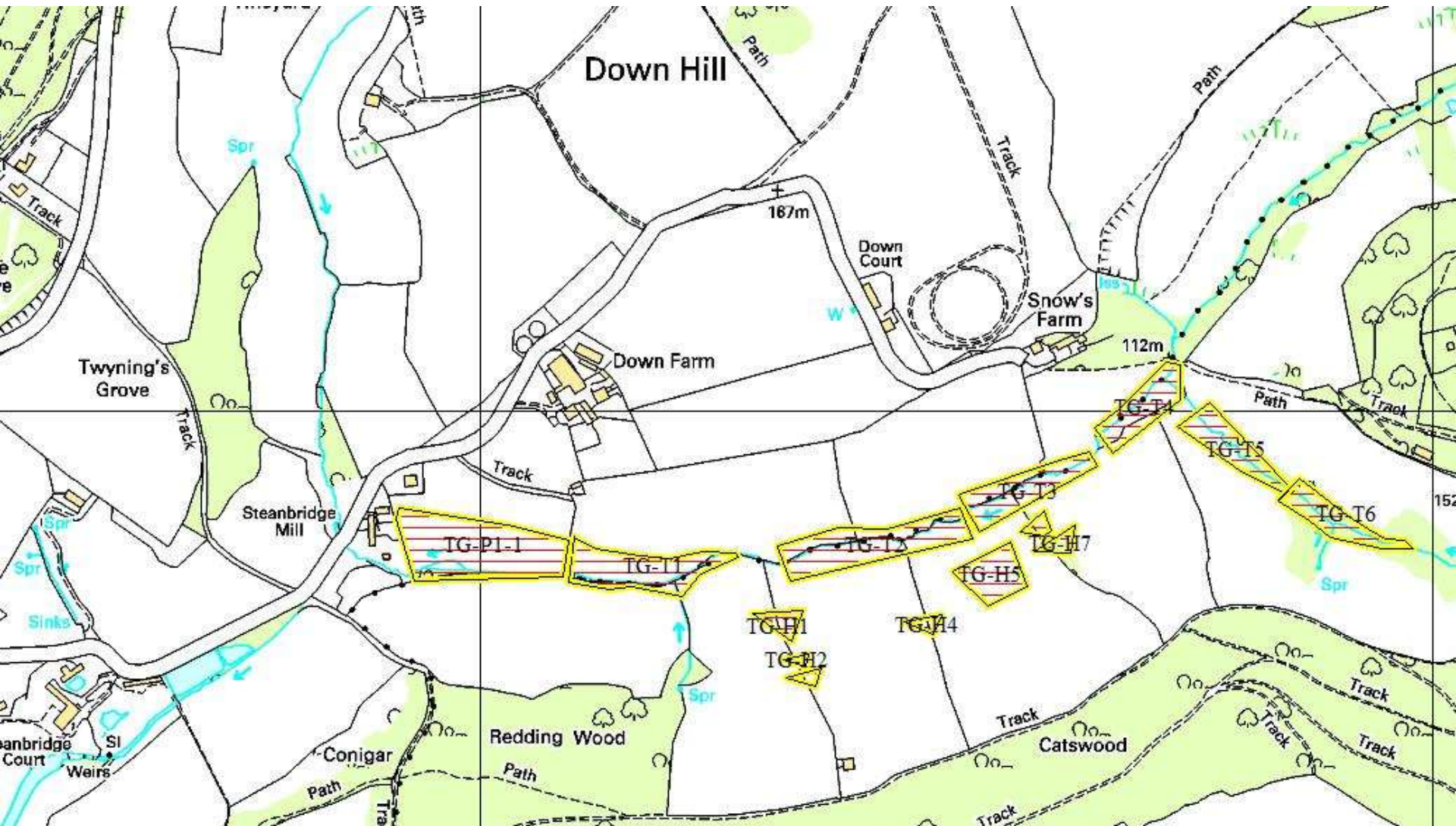
12-Jul-2011

- More 'joined-up-thinking' like this required ... within complete catchment plans to resolve flood & drought.

Benefits of impoundments

Finding space in the landscape to store water where landowners have indicated ...

Slad Brook FAS



Benefits of impoundments

Hydropower



Local experience with hydropower over many years bears no relation to EA regulatory/fishery sensitivity policy

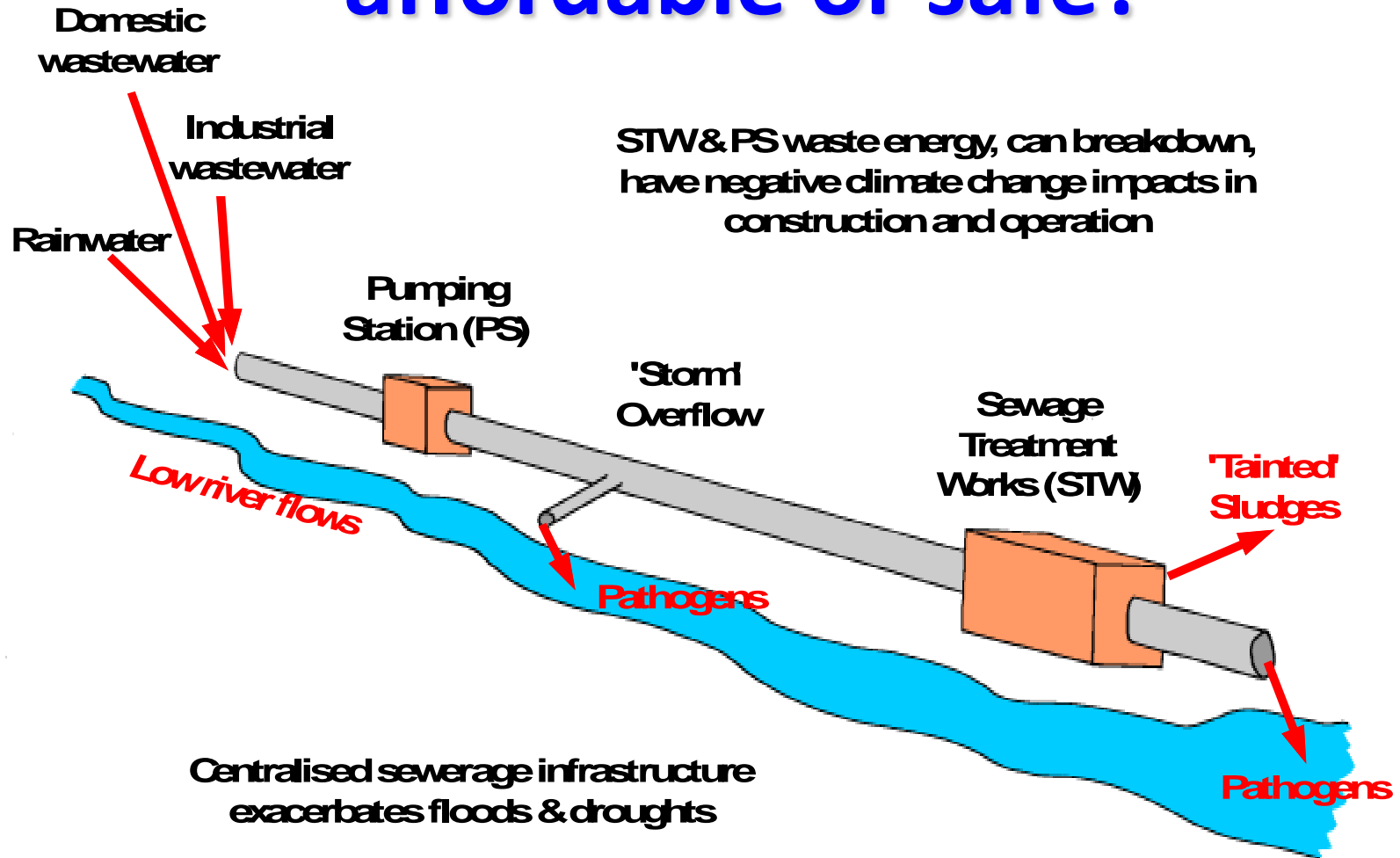
Waterpower benefits biodiversity & river water quality

Enables investment in flood control

Enables investment in fishery improvement

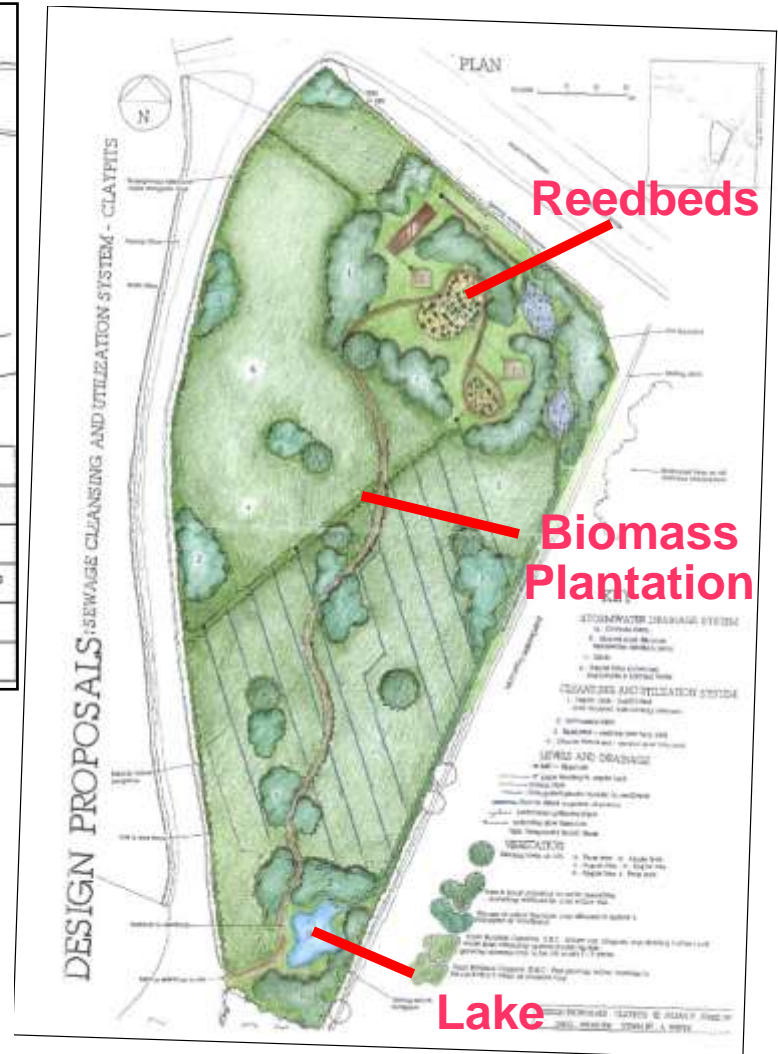
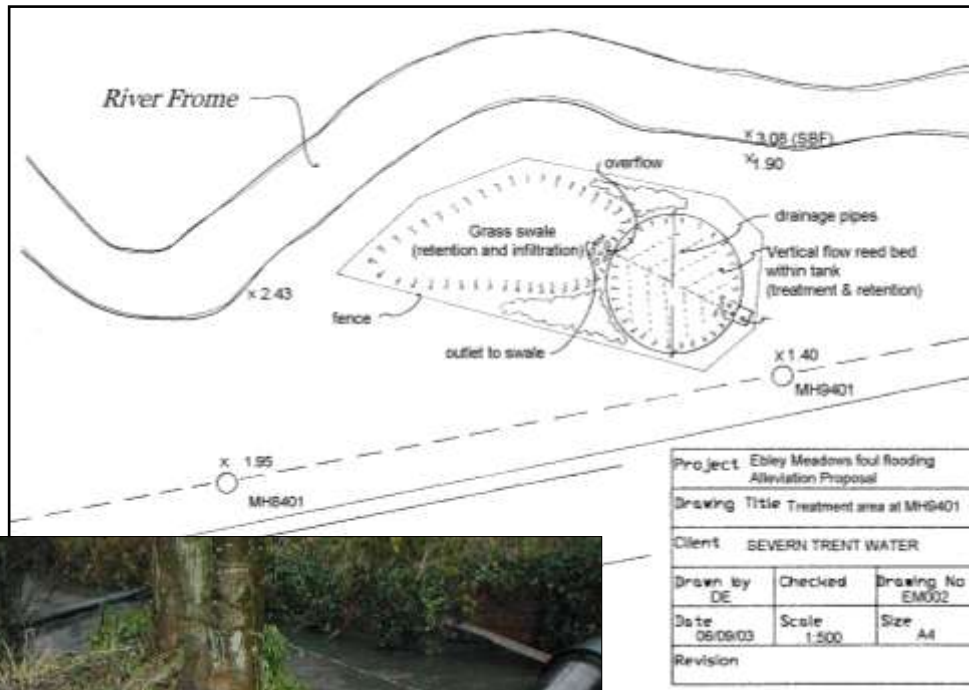
There are important water resource licensing issues for hydropower – which can (along with flood & drought) be resolved by increased water availability resulting from holistic flood and drought control – which hydropower can help fund ...

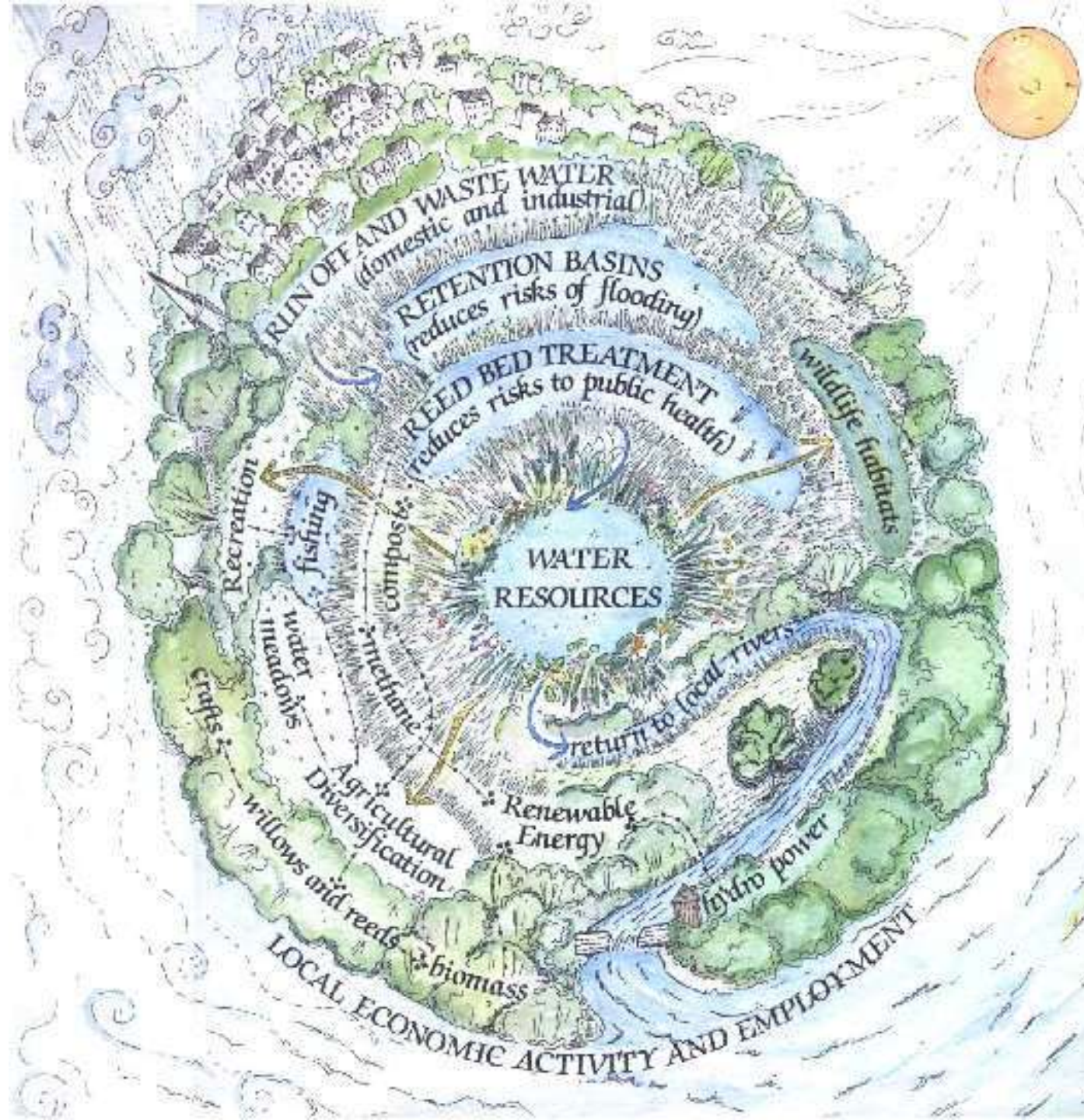
Is centralised sewerage sustainable, affordable or safe?



Sewers amplify the effects of climate change

Constructed wetlands for economically viable sewerage safety & biodiversity





**We need 'Safe
& viable Plans
for Water'
everywhere**

**Functioning
landscapes
that also
benefit water
resources,
livelihoods &
meet WFD**

*Stroud Urban Wetlands
Schematic 1993*

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