Implications of Climate Change on Land Treatment Systems

Hamish Lowe, Jane Petch, Katie Beecroft
Lowe Environmental Impact

Overview

LOWE Environmental Impact

Why is climate change important → Climate change and land treatment → What is changing → Issues for municipal, industrial and onsite systems

Why is climate change important

A change in our climate has been occurring for millennia, but knowing how rapidly changes will occur is unpredictable.

CC change will impact on the infrastructure which services our communities.

Knowing the impact of CC on infrastructure is vital for the ongoing functioning of our communities.

Climate change and land treatment

Land treatment relies on the natural environment

Climate is a key influencer of the natural environment

therefore

CC can alter the performance and sustainability of land treatment systems

What is changing

Rainfall

more and less

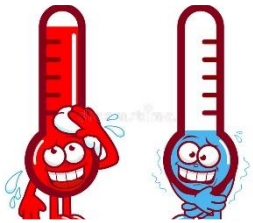
Drought

consequence of no rain

Flooding

consequence of too much rain

Temperature

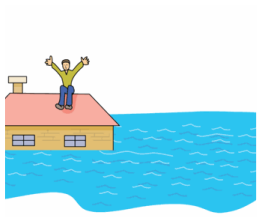


increase, but could be cold

Wind

will blow but could blow harder

Sea level rise

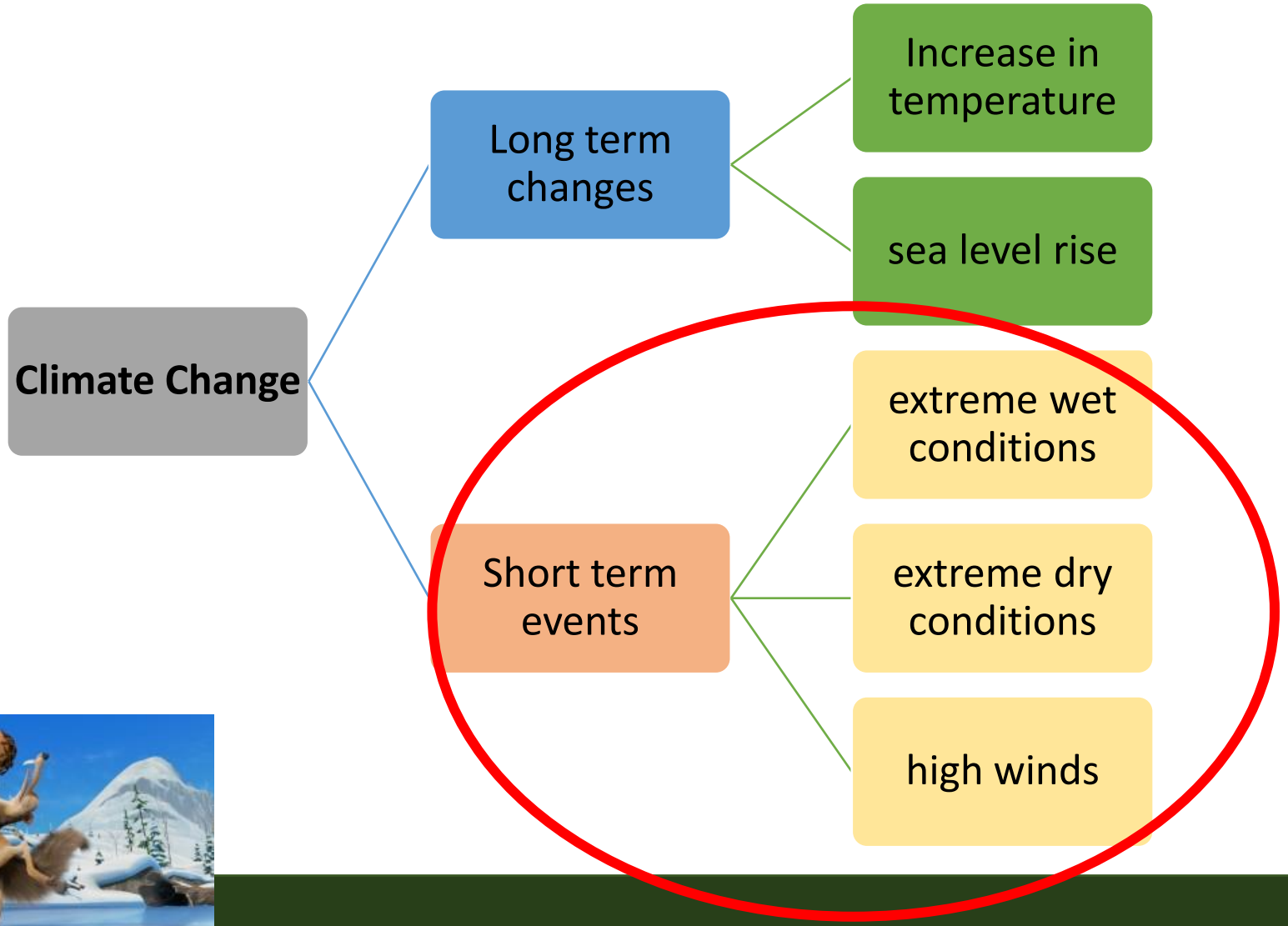


going to increase

Coastal hazards

need to manage surges

So how will CC affect land treatment



What does it mean for LTS?

LOWE Environmental Impact

Key Systems

- Municipal
- Industrial
- Onsite

Considerations

- Collection and Piping
- Treatment System
- Storage and Discharge
- Management
- Consenting

Municipal

Collection and Piping

- Infrastructure old - high I and I
- The mass of contaminants same, but potentially more dilute (wet) … or stronger (dry)
- High GWL higher base flows
- Reticulation capacity exceedances – surcharging and overflows

Treatment System

- Too much flow, or not enough flow – changes to HRTs
- More dilute?
- Have to accept inflow – what is the capacity and is performance compromised
- If upspec – is there redundancy
- What about rain capture?

Municipal

Storage, Land and Water Discharge

- High rainfall will consume storage volume cf low increase evaporation.
- Limited inflow nominal areas cf wet periods lower application greater areas.
- If wet weather basis of design, minimal irrigation benefits.
- If designed on dry flows need alternative – relief valve: storage? Surface water?
- Flows don’t match crop growth; both wet and dry esp if not winter or summer
- More wind = more sensitive receptors?

Municipal

Management

- Variable application and growth
- Season to season very different - might need new crops
- New weeds and pests to manage
- Need flexibility - back up
- Storage and alternative discharge important
- Variable treatment impacts on monitoring variability
- Is soil moisture monitoring relevant – can we run deficit systems

Consenting

- Can we realistically predict effects for AEEs?
- Are changes relevant over the term of the consent – say 35 years
- How manage unforeseen events – are they unforeseen?
- Rather than being numerically prescriptive should conditions be more management based - acknowledge highs and lows
- More focus on comprehensive management plans?

Industrial

Collection and Piping

- Flows to industrial plants will be influenced by production
- However, production influenced by seasonal performance of the largely farming systems
- May have multi year impact beyond season of climate impacts
- Smaller networks and minimal I&I

Treatment System

- Similar to municipal treatment technologies but higher contaminant loads and greater seasonal variation in composition.
- Treatment demand not due to daily peaks, but prolonged periods of high production – limited by production capacity
- Equally, there may be extended periods of lower production, or even a longer shut down duration.
- May need idle mode or even shut down, generating issues for maintaining effluent quality and odour
- Biological treatment systems are often temperature dependent (sensitive) - effluent quality and c

Industrial

Storage, Land and Water Discharge

- Many of the issues that apply to municipal wastes also apply to industrial wastes.
- But two key differences.
  - Firstly, there is not the I&I and hence pressures from extreme weather on wastewater volumes will typically be less.
  - Secondly, flows relate to the rate of productions, meaning that typically there are greater flows during times when vegetation is actively grounding and therefore soils are more receptive to received land applied wastewater.
  - The consequence of the above will mean storage volumes are less critical (can be smaller) and potentially more 'typical' farming crops can be used.

KEY – in an extreme weather event, wastewater flows can be ceased or production diverted

Industrial

Management

- Similar to municipal systems, but wastewater flows more consistent
- Peak production MAY align with irrigation demand – meat different to dairy
- Volumes per day often large compared to municipal systems – more land involved

Consenting

- Similar municipal systems.
- May have peak flows in one year followed by lower flows in the following year => more highs and lows and a less consistent average (more variability).
- May impact on confidence in predicting environmental effects.
- Extreme weather unlikely to impact on the daily production at a processing plant, but may get longer season

Onsite

Collection and Piping

- Reticulation short distance => little I&I
- Coastal systems may be affected by increased groundwater levels resulting from increase in sea level.
- Inundation from storm surges are a potential problem => temporary inundation may be ok

Treatment System

- Inundation from flooding and storm surges key issue (coastal areas esp).
- Erosion also of concern
- Need to consider risk of risk of tank floatation
- Water tightness critical (including control panel)

Onsite

Storage, Land and Water Discharge

- Coastal
- Inundation ok if short term
- Groundwater separation distances over time may be critical esp in coastal areas – may be 100 mm rise in 50 yrs
- May need to consider alternatives e.g. mounds

- Inland
- Prolonged wetness increases system failure risk
- Need innovative design to manage increased occasional wetness
- Might need greater level of treatment (BOD and pathogens)

Onsite

Management

- Currently limited management – only service checks
- Unrealistic for the home owner to do much more
- Maybe make mandatory checks after inundations
- Vegetation and surface water run-on controls important to prolong life and reduce failure

Consenting

- Most systems PA so hard to insist on changes
- Maybe plan changes needed to address and allow for CC issues
- Greater management and or inspection could be applied to critical areas (coastal and floodable areas)

Conclusion

L W E Environmental Impact

Long term climate changes

- They area a fact and a reality
- Land treatment systems likely to be able to evolve
- Design can be managed alongside consent terms
- Avoid knee-jerk changes for the sake of it, but plan for longer term

Short term climate events

- Greater potential impact
- Need to consider how we react to wet and dry conditions
- What are exceptional conditions and how do we design for
- Is more management flexibility preferred over regulatory control
- We need to start developiping solutions now

And the rain, rain, rain came down, down, down
And the rain, rain, rain came down, down, down
And the Hundred Acre Wood got floodier and floodier

Advice AEE Agricultural Analysis Application Approachable Assessments Assimilation Assistance Biosolids Capability Client Communications Communities Compliance Compost Consents Consultation Contamination Coordinate Council Cultural Current Data Degradation Design Detention Developments Discharges Documentation Drafting E. coli Ecosystems Effects Engagement Environment Equipment Evidence Excellence Experienced Expert Facilitating Farming Feasibility Fieldwork First-flush Fit-for-purpose Flooding Fun Geology Graphs Greywater Groundwater Guidelines Handbag Hazardous Hydraulics Innovation Interpretation Investigation Irrigation Land Landfills Landscape Land-treatment Leaching Lodge Management Metals Microbiology Modelling Monitoring NES Nitrogen Nutrients Onsite Optimisation Organics Overseer Papers Pathogens Phosphorus Plain-english Plans Preparation Presentations Project Quality Relevant Remediation Reports Research Review Sampling Scientific Septage Sludge Soil Solutions Spreadsheets Standpipes Stormwater Strategy Support Surface Water Sustainability Systems Team Testing Timely Treatment Validation Wastewater Water Water-balance Waterways