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Program B4.2

Socio-technical flood resilience

Adaptation Tipping Points to determine the resilience of a wetland

Problem statement

Since European settlement over 80% of the Swan Coastal Plain (Perth, Australia) wetlands have been lost. A drying climate exacerbates hydrological stress which results in further loss of ecological values. Here we inform management authorities about the ecological resilience of a wetland. We applied the concept of 'adaptation tipping points' (ATPs) which is defined as when the management strategy is not effective. The strategy consists of maintaining minimum water levels in the wetland mandated by policies and legislation (Table 1)

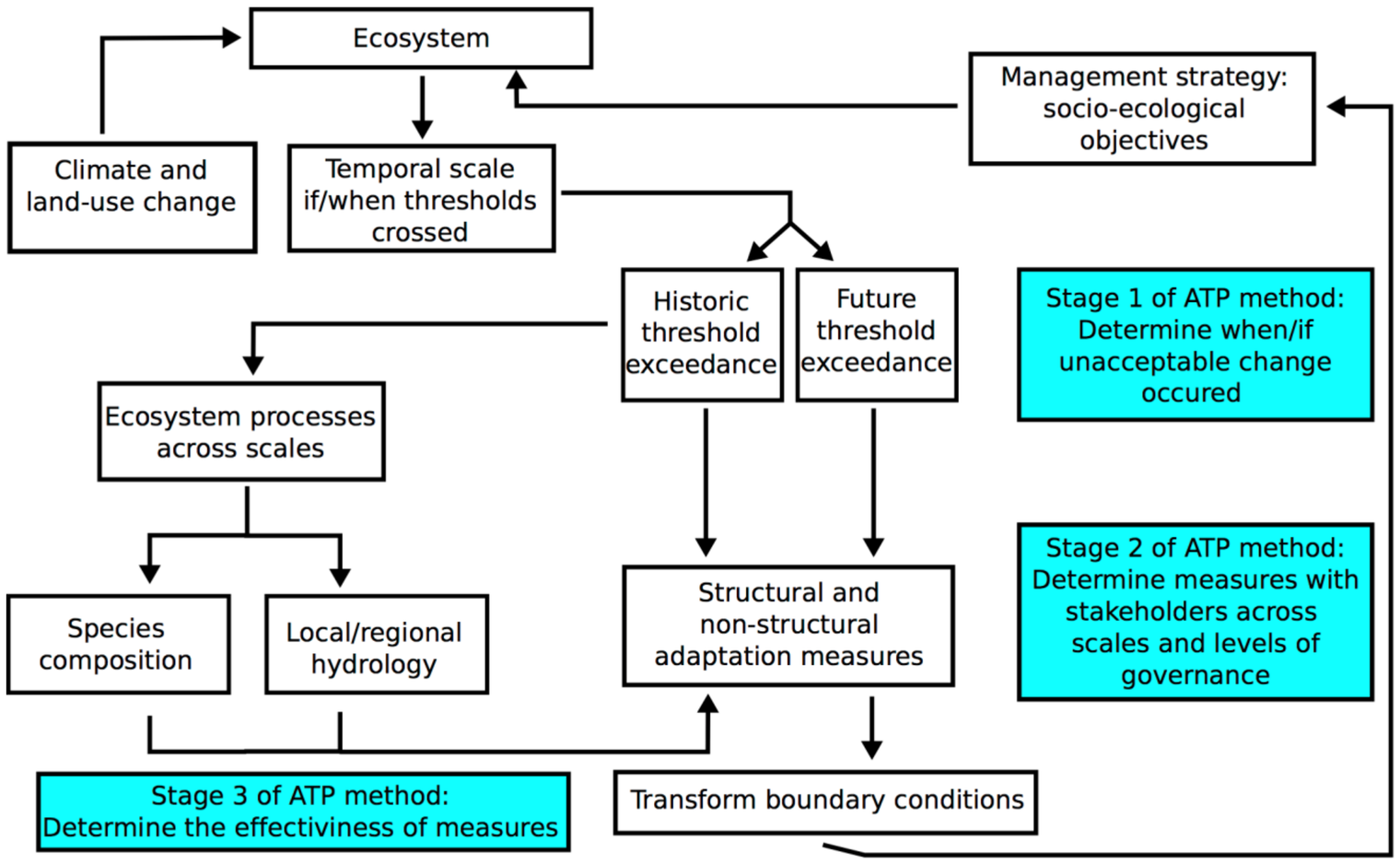

Figure 1. Adjusted Adaptation Tipping Point methodology in 3 steps (Adapted from: Kwadijk, Haasnoot et al. 2010).

Aim

Determine the effectiveness of the current wetland management strategy (Figure 1)

Table 1. Calculation of threshold exceedance for management objectives of Lake Forrestdale (red = exceeded; green = not exceeded; GW = groundwater; SW = surface water; ecological objective from local management plan; threshold = policy)

	Water level (mAHD)		
Ecological objective	**Threshold**	**1978-1995**	**1996-2012**
1. protect vegetation and mammals	SW < 21.6	21.66	21.39
2. prevent mosquitoes	SW < 21.6	21.33	21.41
3. protect waterbirds	SW < 21.6	21.84	21.44
4. protect frogs	SW < 21.6	22.02	21.61
5. protect tortoises	SW < 21.6	21.66	21.39
6. protect macro-invertebrates	SW < 22.0	21.66	21.39
7. prevent exposure of Acid Sulphate Soils	GW < 21.1	21.66	21.39
8. maintain sediment processes	GW < 21.1	21.66	21.39

Conclusions

- Management strategy is ineffective - minimum water levels triggered for 4 out of 8 objectives (Table 1)
- Decrease of rainfall from 1970s - lake responded from a permanently to a seasonally inundated lake in the mid 1990s (lag response of ecology)
- ATP could be used as early warning to adapt management to prevent undesirable ecological changes
- ATPs inform stakeholders to redefine threshold definitions or prioritise management objectives.

Recommendations

- Further research should address ecological variability with duration, timing and rate of seasonal droughts.
- Decision makers could accept the current strategy; adapt this; or combine acceptance and adaptation to establish effective policy and management

Kwadijk, J. C. J., Haasnoot, M., Mulder, J. P. M., Hoogvliet, M. M. C., Jeuken, A. B. M., van der Krogt, R. a. a., de Wit, M. J. M. (2010). Using adaptation tipping points to prepare for climate change and sea level rise: a case study in the Netherlands. Wiley Interdisciplinary Reviews: Climate Change, 1(5), 729-740.

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