

Physical effects of sea level rise on the estuarine environment

- Increased base water level for estuaries and intermittently open and closed coastal lagoons (ICCOLs)
- Increased frequency of high-water episodes for closed ICOLLs
- Geomorphological changes of the estuary and adjacent shorelines
- Reduced drainage capacity and increased costs of drainage both in rural and urban landscapes
- **Expanded tidal influence and seawater intrusion into the catchment and inland migration of the fresh-saline interface****

Image source: US EPA, Climate Adaptation Resource Center

Coastal agriculture coping with sea level rise

Young cow becomes trapped after the bank it was grazing on collapsed
Image source: Phebe Bicknell (Alluvium Consulting)

- CHALLENGES**
 - Increased frequency and range of tidal inundation
 - Increased salinity of soils
 - Loss of grazing land to bank instability
- EFFECTS**
 - Degraded water quality due to land use changes and agricultural run-off
 - Increased sedimentation due to bank instability

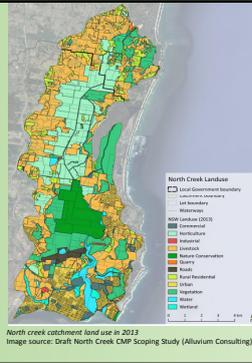
Case Study; North Creek, Ballina

LAND USE TRENDS IN CATCHMENT

- Long history of coastal agriculture
- Declining oyster industry
- Increasing urbanisation
- Decreasing value of agricultural practices

Agricultural Activity	2015/2016 North Creek catchment contribution by land use area	2015/2016 Value added for the Ballina Shire
Macadamia nuts	\$2,710,000	\$34,800,000
Sugarcane	\$1,170,000	\$6,460,000
Grazing (cattle and calves)	\$560,000	\$2,440,000

Data source: Draft North Creek CMP Scoping Study (Allium Consulting)



Case Study; Bellingen Shire Council

WATER QUALITY

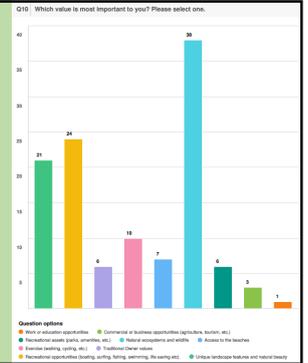
- Agricultural run off from upstream subcatchments
- QX disease has led to closures of oyster farms
- Massive die-off of Bellingen River Snapping Turtle

COMMUNITY VALUES



On the left - Juvenile Bellingen River Snapping Turtle. Photo from Taronga Zoo captive breeding program.

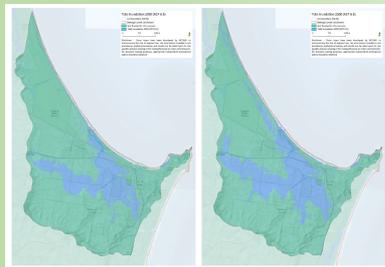
On the right - Responses from Bellingen Shire Council Stakeholder Survey. Survey Report (Allium Consulting)



Case Study; Belongal Creek, Byron Bay

SEA LEVEL RISE and ICOLLS

- ICOLL - History of altered hydrology to expand land use
- Competing interests: urban, ecological, agriculture
- Drainage problems in low lying land
- Stormwater and sewerage infrastructure will be compromised
- Ecological impacts of ASS



The estimated tidal inundation under the existing high emissions trajectory in the Belongal Creek catchment in 2050 (left) and 2100 (right). Image source: Belongal Creek issues Study (Allium Consulting)

Opportunities for mitigation of impacts



Physical structures to prevent sea water ingress



Transition to saline resistant crops



Transition land to saline tolerant ecosystems and use as buffer

References

- Alluvium Consulting Australia (2019). *Belongil Creek Entrance Opening Strategy*. Byron Shire Council. Draft Report
- Alluvium Consulting Australia (2019). *Bellingen Shire Coastal Management Program Scoping Study*. Bellingen Shire Council. Draft Report
- Alluvium Consulting Australia (2019) *Richmond River Governance and Funding Framework*. Office of Environment and Heritage and Shires of Ballina, Byron, Lismore, Kyogle, Richmond Valley and Rous County Council. Draft Report
- Alluvium Consulting Australia (2019). *North Creek Coastal Management Program Scoping Study*. Ballina Shire Council. Draft Report
- Office of Environment and Heritage (2018) Coastal Management Toolkit

The logo for Alluvium Consulting Australia, featuring the word "alluvium" in a lowercase, sans-serif font. The letter "i" is stylized with a small yellow dot above it. The logo is positioned in the bottom right corner of the green reference box.