STATEMENT BY CAPE YORK SCIENTISTS ON LAND USE DEVELOPMENT AND VEGETATION CLEARING OF NATIVE WOODLANDS

The rivers, wetlands and marine ecosystems of Cape York Peninsula are of high ecological and cultural value. These aquatic ecosystems are relatively healthy compared to more developed parts of Australia and the world (Halpern et al. 2008). Prior to the recent coral reef bleaching event on the northern Great Barrier Reef (GBR), coral reefs off the East Coast of Cape York were identified as being in good condition, with higher live coral cover and fish diversity than the rest of the GBR south of Cooktown (Fabricius et al. 2005). Given the severe permanent declines in live coral documented in the central and southern parts of the GBR (De'ath et al. 2012), the northern GBR is the last stronghold of healthy reefs. Therefore, the maintenance and improvement of water quality in the Northern GBR should be one of the highest priorities for the overall management of the GBR. The recent bleaching event, which has affected a large percentage of corals in the Cape York region, highlights the importance of maintaining good water quality in the northern GBR section, as reefs may recover from current or future bleaching events if the surrounding water quality is good (i.e., low sediment, nutrient and pollutant levels).

Maintaining healthy water quality in rivers, wetlands and the marine environment requires looking after the land to minimize land use impacts on waterways and the GBR. Many years of research by local community groups, indigenous rangers, research organisations and government departments have documented the impacts of land use on Cape York's aquatic ecosystems (Howley et al. 2010; Howley et al. 2012; Gleeson 2012; Shellberg and Brooks 2013; Brooks et al. 2013; Spencer et al. 2016; Shellberg et al. 2016).

The following facts must be considered in the current debate over vegetation management legislation, land use development, and their impacts on Cape York waterways and the GBR:

- Sediment erosion is the largest threat to river water quality and Great Barrier Reef ecosystems in eastern Cape York.
- Despite the perception that Cape York is relatively pristine (which by comparison to other areas it is), there have been significant declines in catchment water quality.
- Accelerated soil and gully erosion in some Cape York catchments has been caused by 1) over 100 years of cattle grazing on sensitive soils along small creeks and river frontage, 2) over-grazing on slopes leaving soils bare and disturbed before the wet season rains, 3) hot fires, leaving bare soils before wet season rains, and 4) the clearing of native trees and disturbance of soils for grazing, agriculture, roads, tracks, fences or other developments. In some places erosion rates are 10 times their pre-European settlement (natural) rates.
- Accelerated soil erosion is also associated with accelerated nutrient inputs, which is a major driver of Crown of Thorns Starfish (COTS) outbreaks. The initiation zone for COTs outbreaks for the entire GBR includes reefs along the southeastern coast of Cape York in the path of flood plumes from coastal rivers. COTS outbreaks also occur on reefs off Princess Charlotte Bay that are in the path of flood plumes from the Normanby River.
- In the Normanby catchment alone, over 10,000 hectares of land has been cleared for roads and fence lines, much of which is now subject to accelerated soil erosion.
- Nutrient levels are 10 times higher than natural in the Laura River downstream from horticultural land use in the Lakeland region (Howley 2010). Increased land clearing for agriculture crop production will also increase nutrient run-off into adjacent rivers.
- In the Normanby Catchment (2,422,800 ha), remote sensing data indicate that cleared forests for pasture and agriculture currently cover ~22,678 ha of land (Shellberg,

unpublished data), including very recent vegetation clearings. At least another >7,990 ha of land has been cleared for major roads and tracks in the catchment (Spencer et al. 2016). Thus, at least 1.3% (30,668 ha) of the catchment has already been cleared and highly disturbed. Recently proposed clearings on several properties, as approved under old legislation in January 2015, would clear an additional 33,784 ha of native woodland. If cleared, these proposals would increase the cleared area in the Normanby catchment by 2.1x or 210%, resulting in 64,452 ha of total cleared land across 2.7% of the catchment.

- This scale of vegetation clearing on Cape York would have major impacts on sediment and nutrient pollution, following the path of water quality degradation in southern GBR catchments (i.e. Burdekin & Fitzroy). Existing clearings in the Normanby catchment have increased soil erosion and nutrient pollution, and new clearings would be no different.
- Water resources development in existing agricultural areas in the upper Laura catchment have already over-allocated groundwater aquifers (QDNRM 2013ab), affecting spring water discharge and downstream river baseflows in the dry season (Shellberg, unpublished data). Additional clearing of land for agriculture, dam building across numerous creeks and rivers, and extraction of ground water will cumulatively reduce the environmental flows required to maintain downstream aquatic ecosystems and cultural uses of the rivers, including subsistence, recreational and commercial fishing in the Laura River, Lakefield National Park and the Normanby estuary.
- Weeds such as Sicklepod, Grader grass, Hymenachne, Wynn cassia, Gamba grass, and many others have been introduced and spread by agricultural development on Cape York. Most existing areas cleared for “improved pasture” on Cape York are heavily infested by weeds, making these lands unproductive for their original purpose and economically unviable. Additional clearing for agricultural development will accelerate the introduction and spread of weeds, resulting in the further loss of riparian zones, biological diversity, and grazing land.

This objective scientific evidence validates the need for improved management of vegetation clearing on Cape York, including greater control of what areas can be cleared and monitoring of the impacts that result from approved clearings to prevent major disturbances of water quality and ecosystem health.

Incorrect statements and assumptions are being made by those opposed to the proposed Queensland vegetation management legislation. These opinions completely ignore the existing science from Cape York and across Queensland. False statements include the idea that there is no evidence of environmental degradation from past or present agricultural clearing on Cape York, or that clearing for agriculture could actually reduce water runoff, erosion and nutrient levels due to the increased vegetation cover resulting from planted crops or “improved pasture”. These opinions are incorrect for the following reasons:

- Both trees and grass provide hydrologic protection of soils, intercept and transpire rainfall and soil moisture, and promote shallow and deep water infiltration into soils, respectively.
- In healthy savanna ecosystems on Cape York, a good balance of tree and grass cover is essential for hydrologic function and resistance of soils to erosion. If the grass is over grazed or becomes weed infested, and tree density thickens, this balance can be upset promoting erosion. But wholesale tree clearing is not the solution to vegetation thickening. Rather, reduced grazing, improved fire regimes, and weed management are essential for increased grass cover.
- The notion that “improved pasture” will improve vegetative cover and hydrologic function does not take into account the loss of deeper infiltration along tree root paths, and the fact

that “improved pastures” are generally stocked at higher cattle densities than native paddocks and grazed down to minimal cover levels just before the onset of the wet season, leaving soils exposed to rainfall.

- The notion that rain-fed crops such as sorghum will provide improved vegetation cover is false, as these annual crops will be harvested in the dry season, and these soils will be bare and exposed and disturbed from harvest during the first rain events of the wet season.
- Perennial vegetation cover (grass and trees) is essential for soil erosion protection at the beginning of the wet season, and agriculture development will not improve this cover over natural background conditions.
- The continued annual soil disturbance from agriculture will consistently disturb and expose soils to erosion, permanently elevating sediment yields.
- We also know that most nutrients in these depauperate soils are concentrated in the upper 10-20 cm of the soil profile, and that it is the nutrient pool contained within these surficial soils that are typically eroded upon clearance and with ongoing cultivation or gully erosion (Burton et al., 2015; Garzon-Garcia et al., 2016).
- The poor nutrient levels in most Cape York soils will require the application of fertilizers for agriculture. As seen in the Laura catchment and elsewhere, this nutrient application will increase the pollution of downstream receiving waters and the GBR.

In addition to all of these issues, consideration also needs to be given to the impact that an expansion of land clearing on Cape York will have on increasing carbon emissions. Global climate change is the greatest threat to the northern GBR, through increased cyclone magnitude and frequency, ocean acidification and increased frequency and intensity of bleaching events. Hence, impacts on carbon emissions need to be at the forefront of all decisions regarding vegetation management on the Cape.

In summary, the scientific evidence is strong that vegetation clearing and agricultural land use has already resulted in increased levels of sediment and nutrient pollution in some Cape York catchments, which will increase with more clearing following the degradation trajectories experienced by southern GBR catchments. If we hope to maintain healthy rivers and reefs, Cape York must not repeat the same mistakes that have occurred in southern GBR catchments. Instead it is critical that we:

- Avoid further pollution by minimizing clearing of native vegetation,
- Maintain low nutrient and pesticide levels in rivers that have not been exposed to agricultural chemicals,
- Maintain healthy river flows throughout the year by carefully regulating the extraction of water from river systems and bores,
- Focus agricultural development on existing cleared areas with high quality soil (e.g., basalt) following international best management practices (BMPs) and “precision agriculture”.
- Assess new proposed clearings for agricultural development with detailed environmental, cultural and economic impact reviews based on field surveys. The scale and detail of the assessments should be measured by the scale of the proposal and relative size of the property. Small clearings could be assessed at a different level of detail to large proposed clearings, depending on the vegetation community and regional ecosystem. Clearings of thousands or tens of thousands of hectares, (like recent clearings of 3,000, to 30,000 and 60,000 hectares), must be assessed by full scale environmental impact assessments subject to public review and the “no action” alternative.

Signed,

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Jeffrey Shellberg, PhD, MSc, BSc is an independent Hydrologist and Adjunct Research Fellow at Griffith University. He is a Cape York property owner and has 10 years of field experience working and living on Cape York researching land use impacts on soil and gully erosion in the Mitchell and Normanby catchments, and identifying best management practices to reduce land use impacts on waterways. This work is a continuation of Jeff's 25-year career as a Stream Hydrologist focused on actively restoring degraded river systems and avoiding river degradation through improved land use management.

Dr Andrew Brooks is a Fluvial Geomorphologist and senior research fellow at the Griffith University Centre for Coastal Management with > 20 years experience in the application of river science to the management of rivers and catchments in Australia. He has published widely on the influence of landscape disturbance on river and catchment processes and has been at the forefront of developing innovative approaches to rehabilitating rivers. He has spent the last 12 years undertaking research on the geomorphology of Australia's tropical savannah rivers – particularly throughout the Gulf of Carpentaria and Cape York. Andrew has led several large research projects that have highlighted the sensitivity of the tropical savannah to erosion – be it associated with disturbances such as overgrazing, poorly designed roads or mining. He was a program leader within the Tropical Rivers and Coastal Knowledge (TRaCK) program from 2007-11 and from 2009 led the Reef Rescue Normanby Sediment budget project. From 2012–14 he led a large Qld Smart Futures project looking at channel bank erosion throughout Queensland, including the Normanby catchment. He is a member of the science advisory panel for the Cape York Water Quality Improvement plan, and a member of the Qld Government sediment working group for managing water quality to the GBR.

Jon Brodie is Chief Research Scientist with the Centre for Tropical Water and Aquatic Ecosystem Research, James Cook University, Townsville and leads the Catchment to Reef Research Group. https://research.jcu.edu.au/tropwater/people/research-staff/jon-brodie He is also a Senior Researcher and Partner with C2O Consulting. http://www.c2o.net.au/#!people/cqqk. For the last 40 years his career has encompassed environmental research and consultancy and the management of marine and freshwater pollution. He spent 1978 - 1988 as an environmental researcher/consultant and Director of the Institute of Natural Resources with the University of the South Pacific, Suva, Fiji. For 11 years he managed the Water Quality Research and Management Program of the Great Barrier Reef Marine Park Authority and has worked in environmental research and management for the last 15 years while at James Cook University. His primary area of interest is research and management with respect to water quality issues for the Great Barrier Reef, but he has also worked extensively overseas, recently in the Middle East, the Pacific islands and South East Asia. He has published over 100 peer reviewed articles in this field as well as more than 200 technical reports. He is heavily involved in policy advice to Australian governments regarding management of water quality issues for the Great Barrier Reef. He was the lead author of the Scientific Consensus Statement (2008 and 2013) documenting the status of knowledge and management for water quality issues affecting the Great Barrier Reef for the Queensland Government. He also sits on a number of panels providing scientific and policy advice for this issue. He works closely with CSIRO, AIMS and the Queensland Government research agencies in his research.

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