

# **Current water quality issues in the Rotorua lakes**

## **within a context of the issues facing all New Zealand lakes**

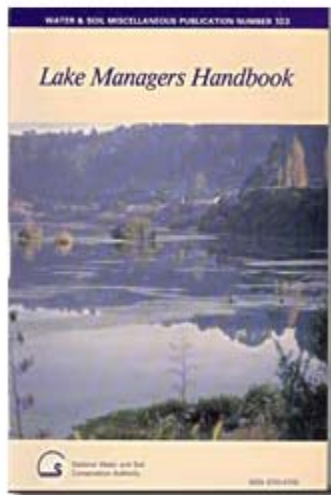
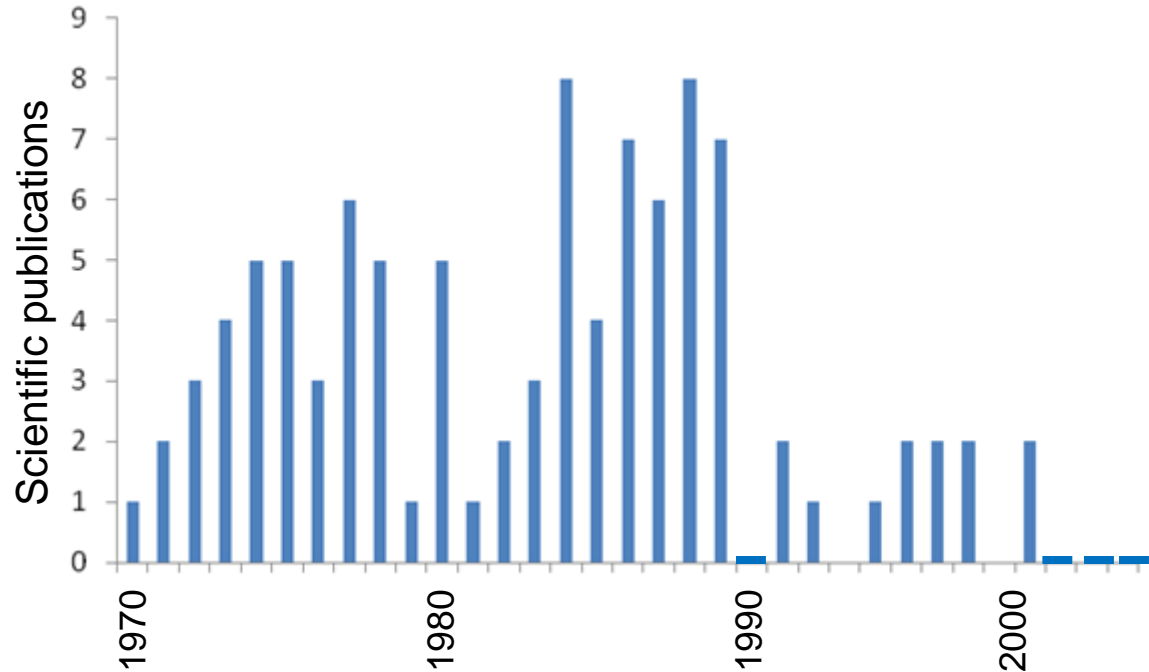
**David Hamilton**

Environment Bay of Plenty Chair in Lakes Management and Restoration  
University of Waikato



# State of knowledge

- NZ a world leader in lake ecosystem science in 1980s (e.g. Taupo Lab, publications on central NI lakes)
- WQ perceived as 'mostly OK' at the time of Lake Manager's Handbook (1987) (e.g., point sources being addressed)



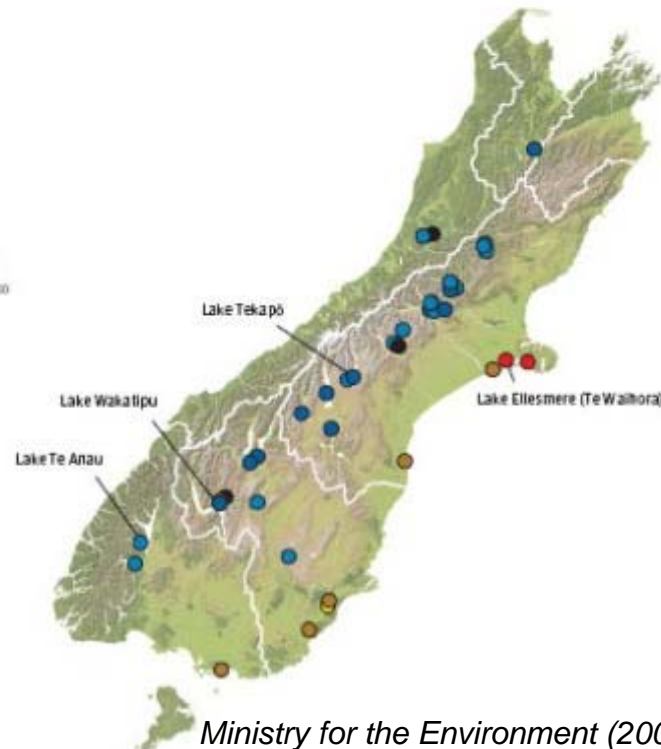
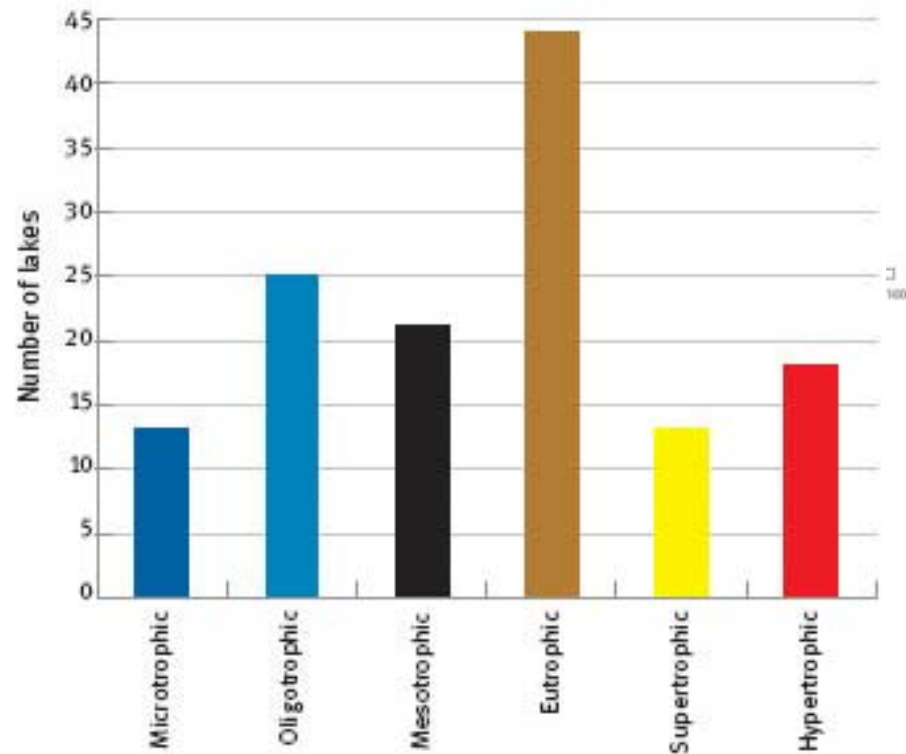
- Lake monitoring progressively reduced in national programme (e.g., 23 to 6 lakes from 1992 to 1998)
- Recent increases in science output (e.g., 5 publications in press in 2010)

# State of the lake resource

## *Trophic Level Index*

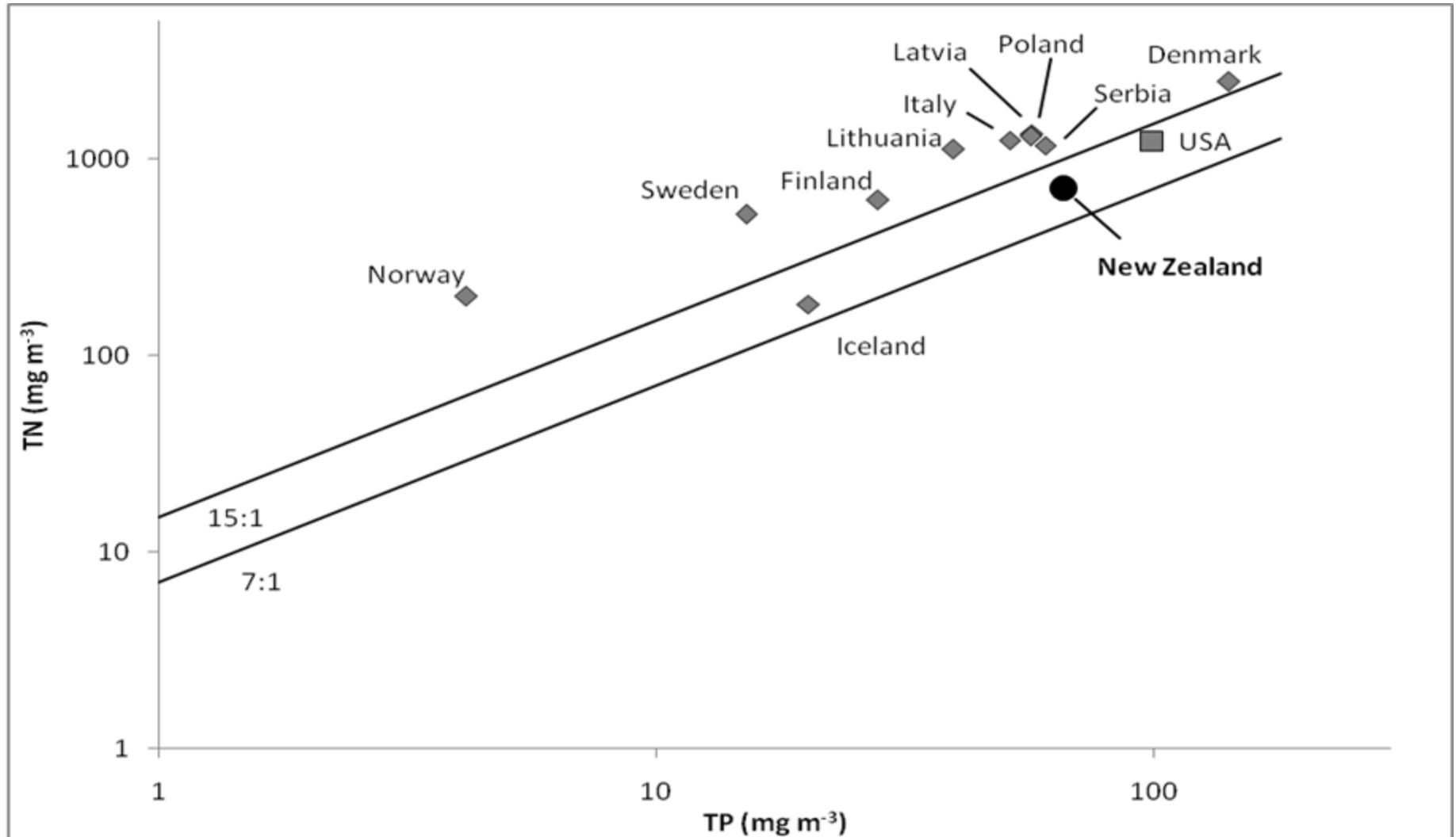
Nutrient and chlorophyll concentrations, and transparency in surface waters used to determine trophic status

- Microtrophic (13) – very low nutrients (pristine)
- Oligotrophic (25) – low nutrients
- Mesotrophic (21) – moderate nutrients
- Eutrophic (44) – high nutrients
- Supertrophic (13) – very high nutrients
- Hypertrophic (18) – saturated with nutrients (extremely degraded)
- Regional council boundaries in white



Ministry for the Environment (2006)

# A comparison with N and P in lakes internationally



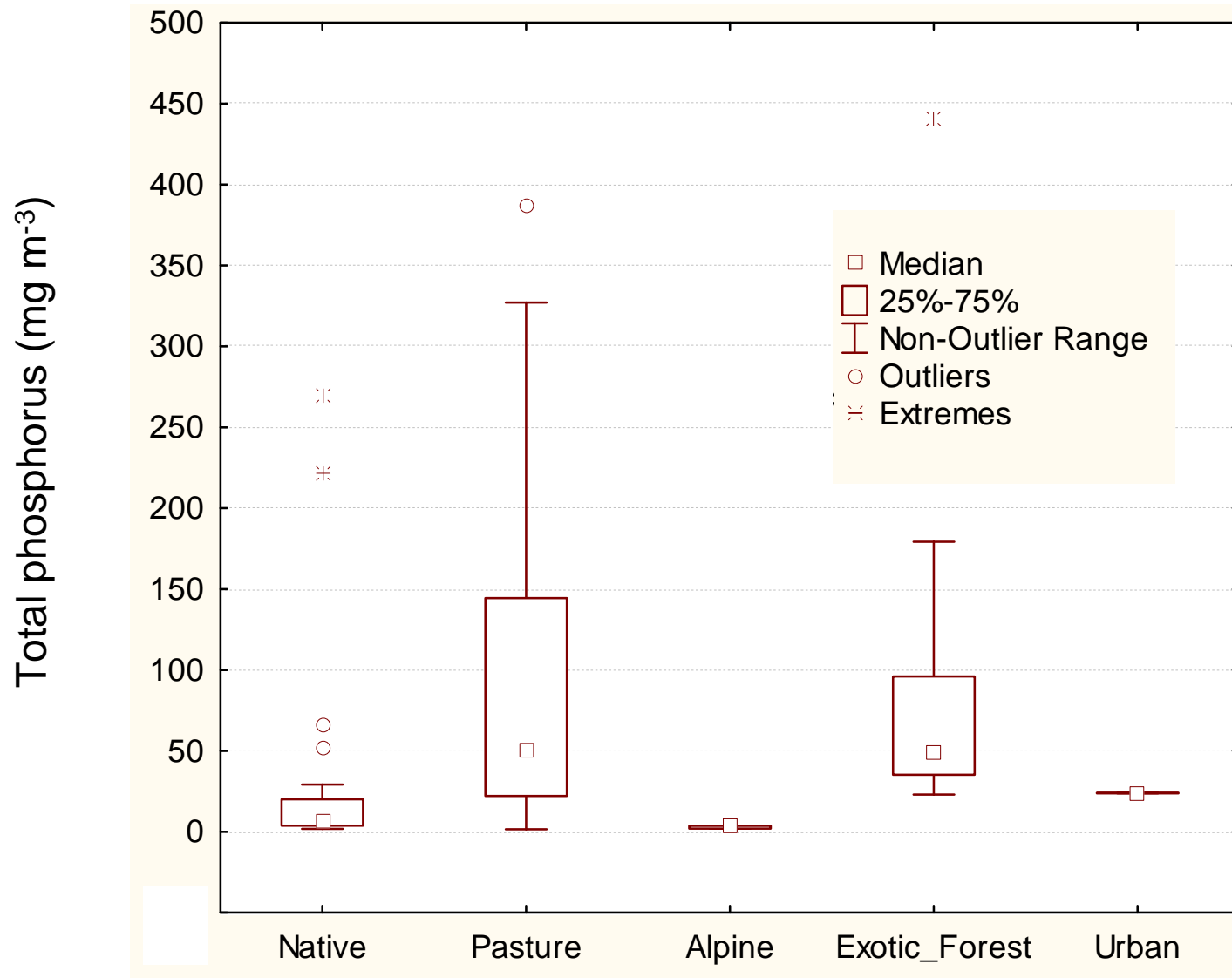
But what could be driving a decline in water quality?





# Total phosphorus and land use for 109 NZ lakes

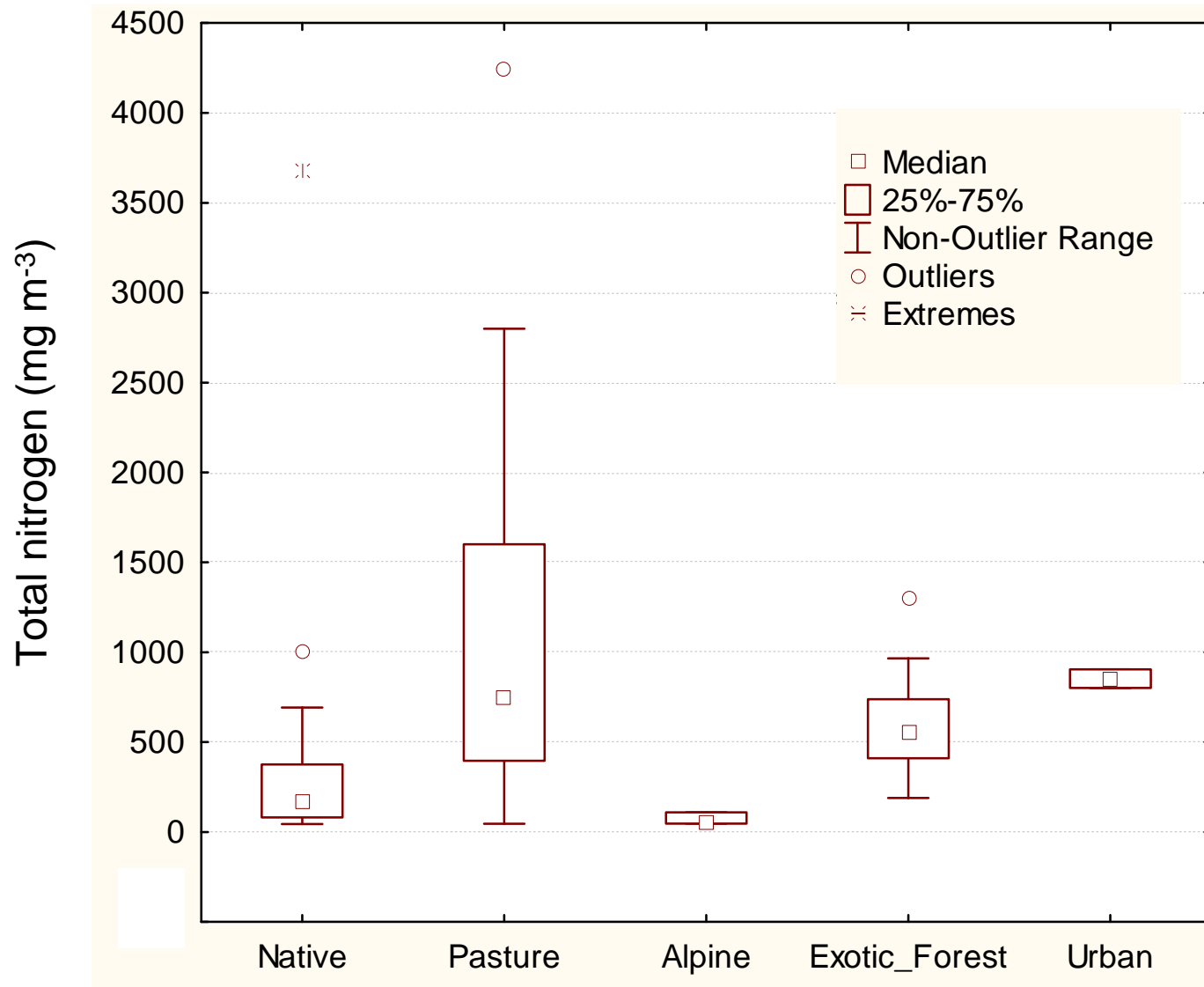
*Credit: Deniz Ozkundakci and Jonathan Abell*



**Key message: pasture and exotic forest 'leak' a lot of phosphorus**

# Total nitrogen and land use for 109 NZ lakes

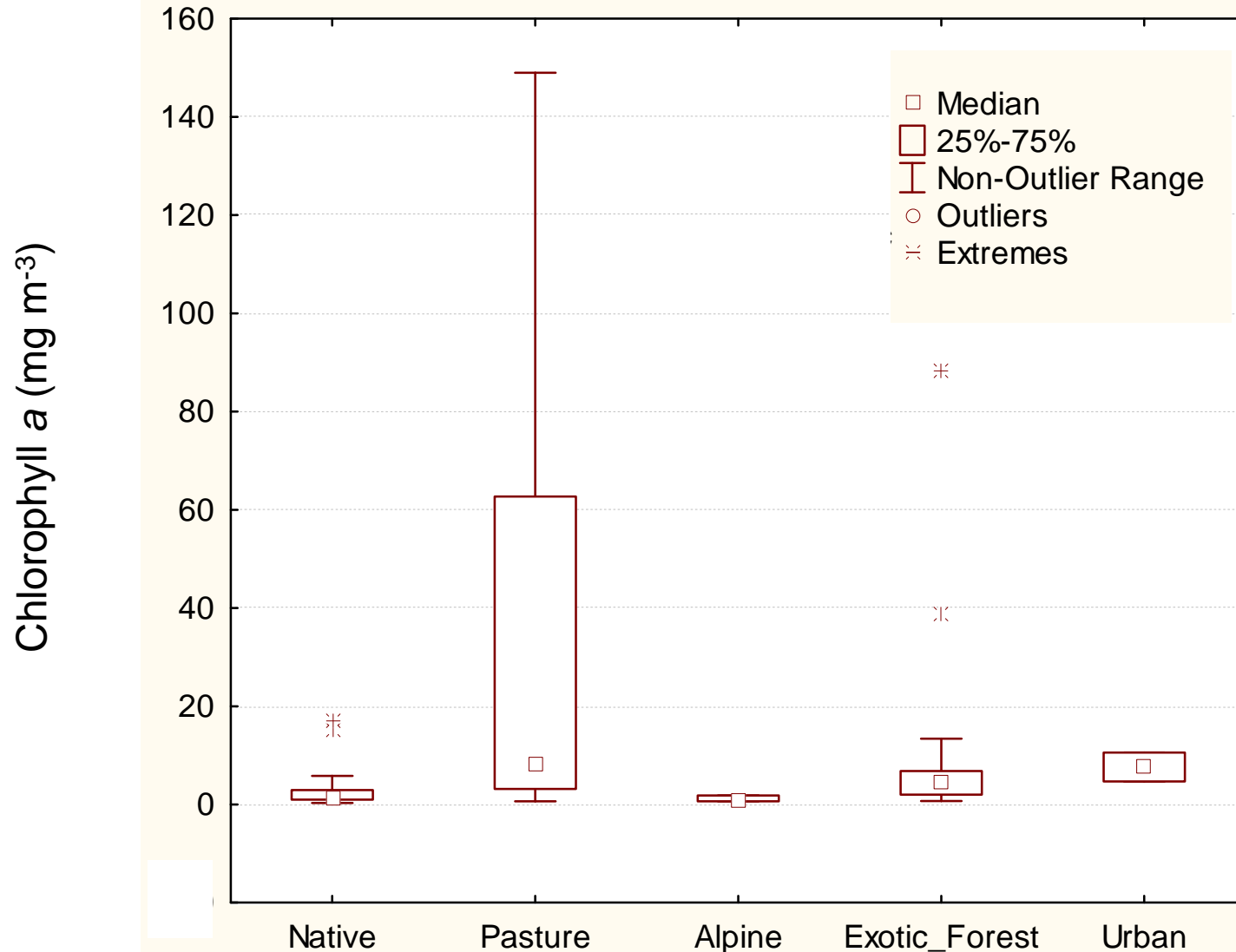
*Credit: Deniz Ozkundakci and Jonathan Abell*



**Key message: pasture, exotic forest and cities 'leak' a lot of nitrogen**

# Chlorophyll *a* and land use for 109 NZ lakes

*Credit: Deniz Ozkundakci and Jonathan Abell*

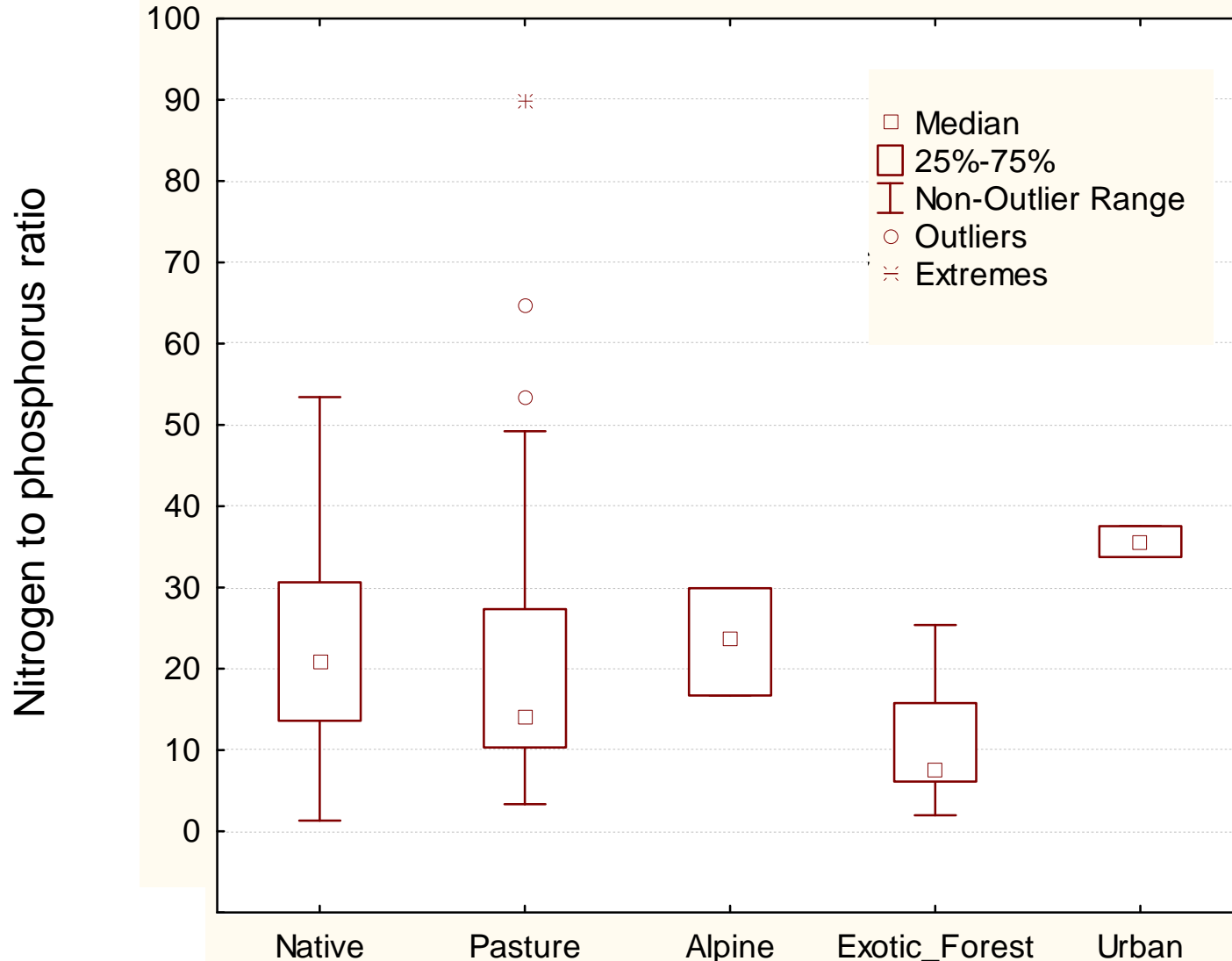


**Key message: choose your lake water quality according to land use**



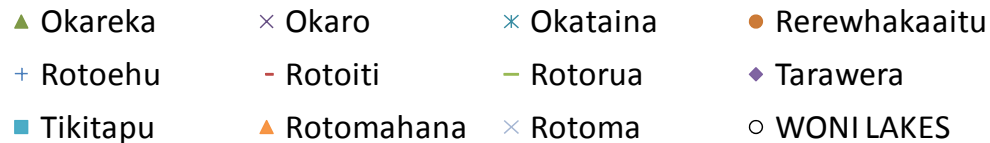
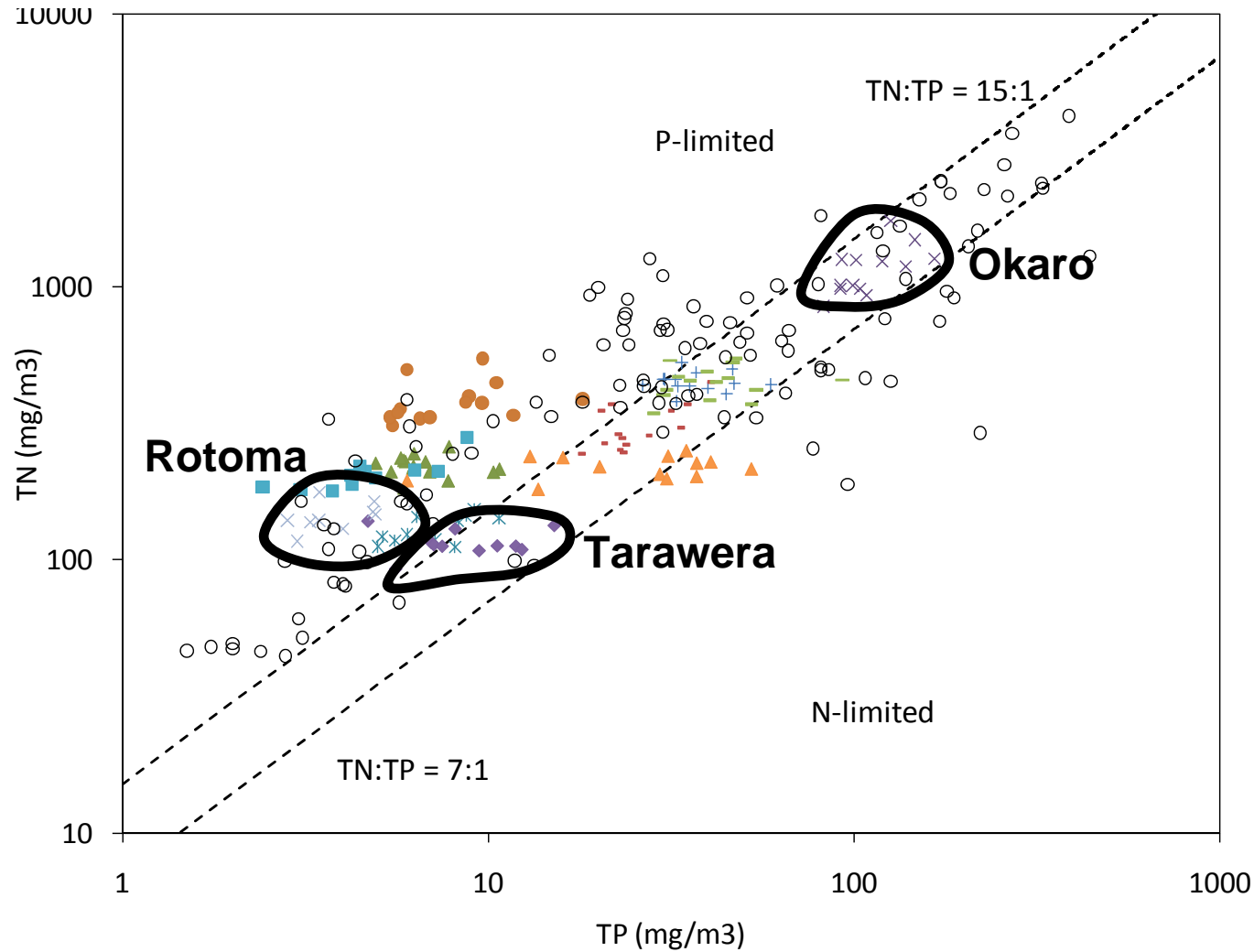
# Nitrogen/phosphorus ratio and land use 109 NZ lakes

*Credit: Deniz Ozkundakci and Jonathan Abell*



**Key message: N/P decreases in exotic forest lakes could make them susceptible to blooms of N-fixing blue-green algae**

# Nitrogen and phosphorus in Rotorua (and NZ) lakes



*Credit: Deniz Ozkundakci  
and Jonathan Abell*

# Nitrogen and phosphorus in Rotorua lakes vs predominant land use

*Credit: Deniz Ozkundakci and Jonathan Abell*

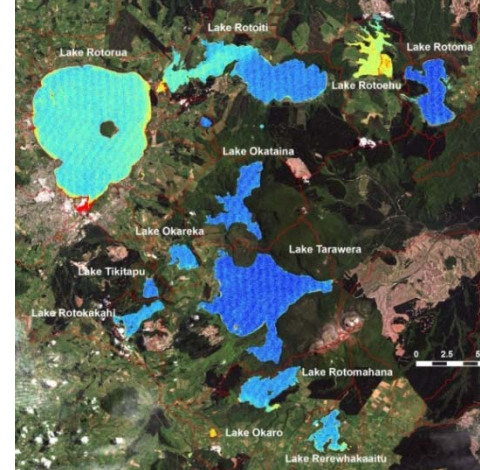
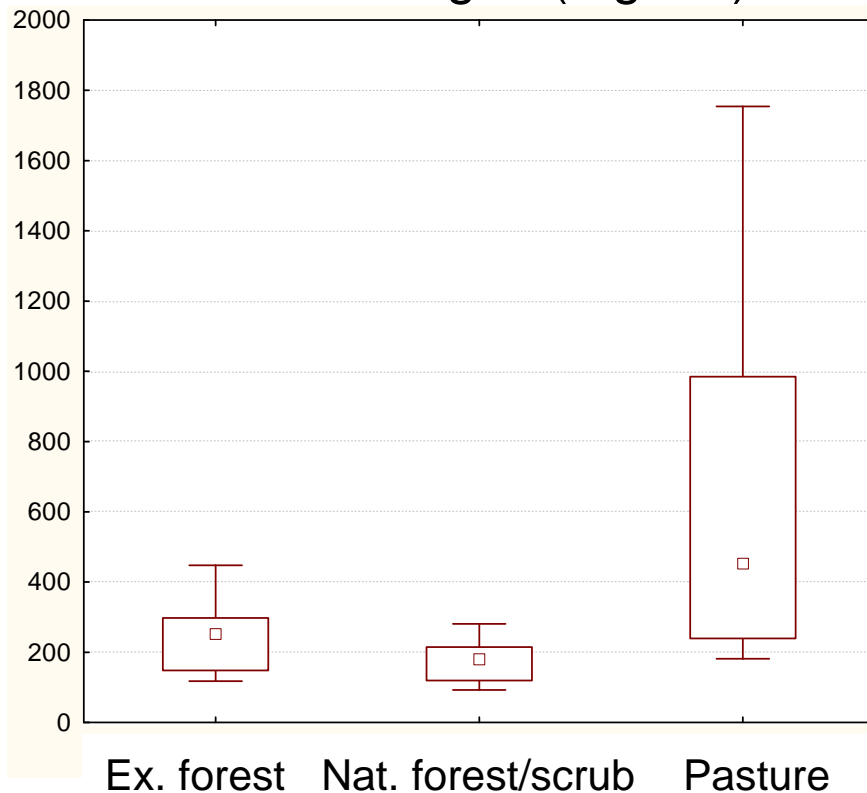
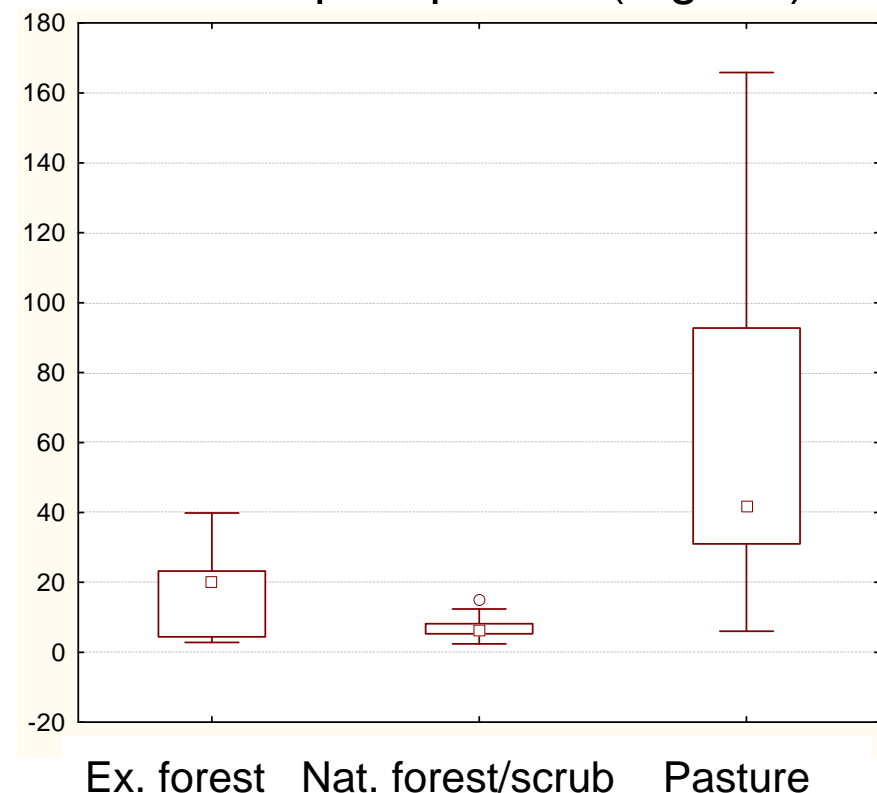


Image: Mat Allan

## Total nitrogen ( $\text{mg m}^{-3}$ )

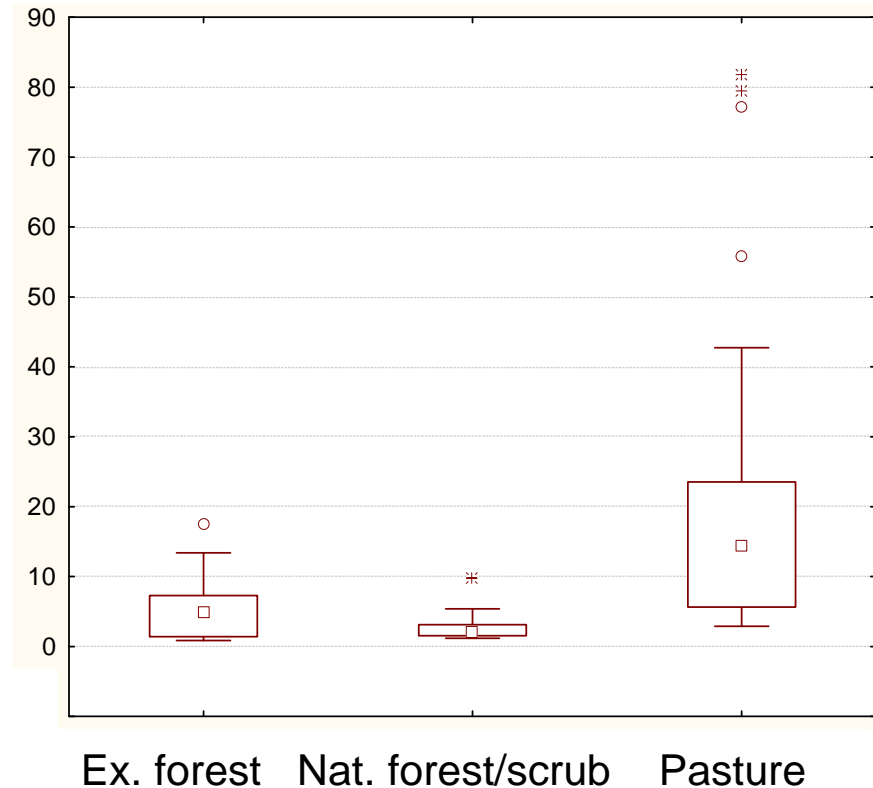
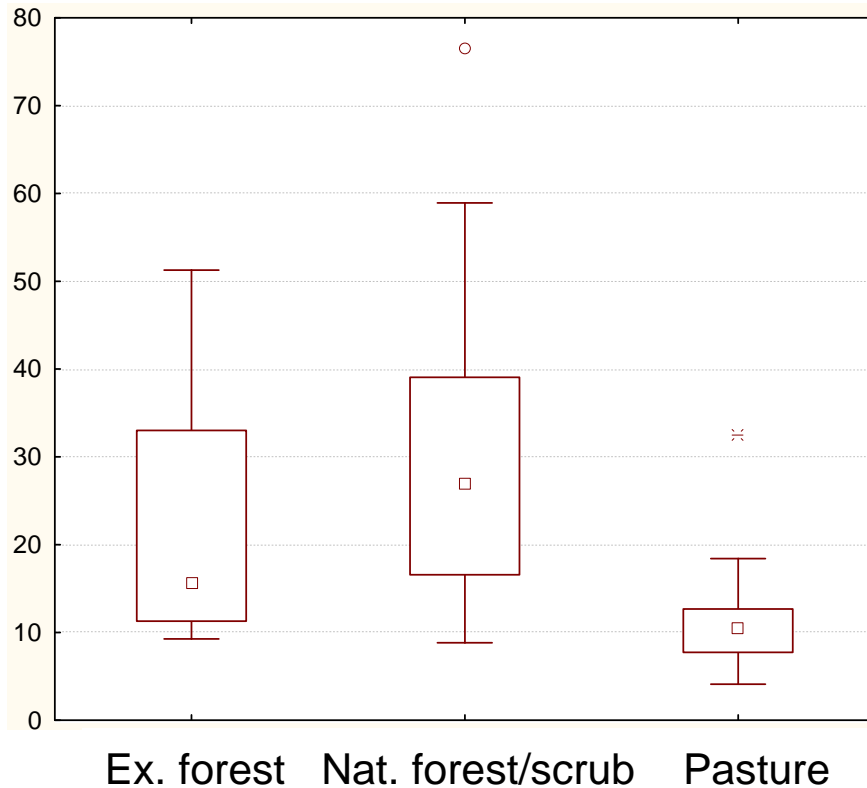


## Total phosphorus ( $\text{mg m}^{-3}$ )



This map shows the central North Island of New Zealand, focusing on the Taupo region. The lakes are labeled as follows: Lake Rotorua (top left), Lake Rototiti (top center), Lake Rotomahana (top right), Lake Okataina (center), Lake Okareka (middle left), Lake Tarawera (middle right), Lake Tikitapu (lower middle left), Lake Rotokakahi (lower left), Lake Okaro (bottom center), and Lake Rerewhakaaiti (bottom right). The lakes are colored in shades of blue and green, indicating different water levels or depths. A scale bar at the bottom right shows distances of 0, 2.5, and 5 km. The surrounding land is shown in various shades of green and brown, representing different land uses and vegetation.

**Image: Mat Allan**



# **Key messages for the Rotorua lakes**

**(relative to other NZ lakes)**

- **N/P ratios are naturally lower in Rotorua lakes**
- **Further decreases in N/P ratios with nutrient enrichment makes Rotorua lakes that are in pasture especially susceptible to blooms of N-fixing blue-green algae**

# Specific issues in the Rotorua lakes

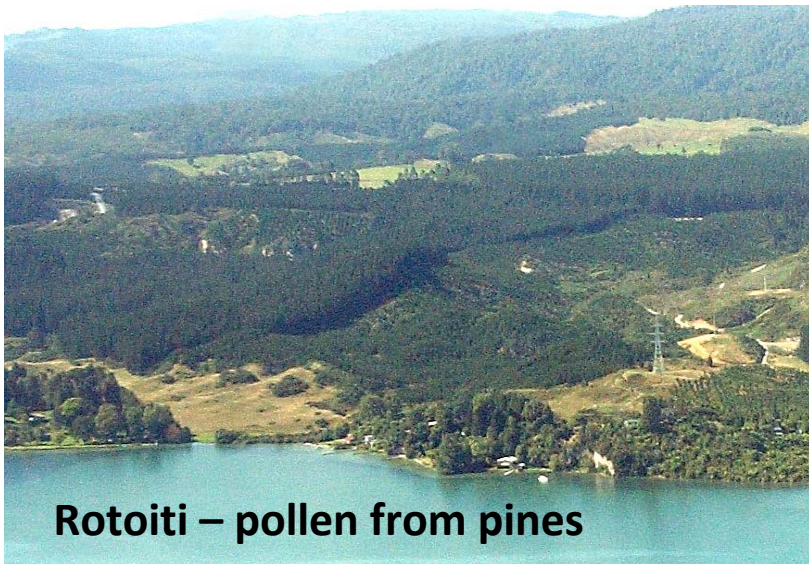


**Rotoma – beach formation**



**Okataina – invasive weeds**

Photo: Dennis Trolle



**Rotoiti – pollen from pines**

Photo: Rotorua Daily Post



**Rotorua wastewater**

Photo: Rotorua District Council



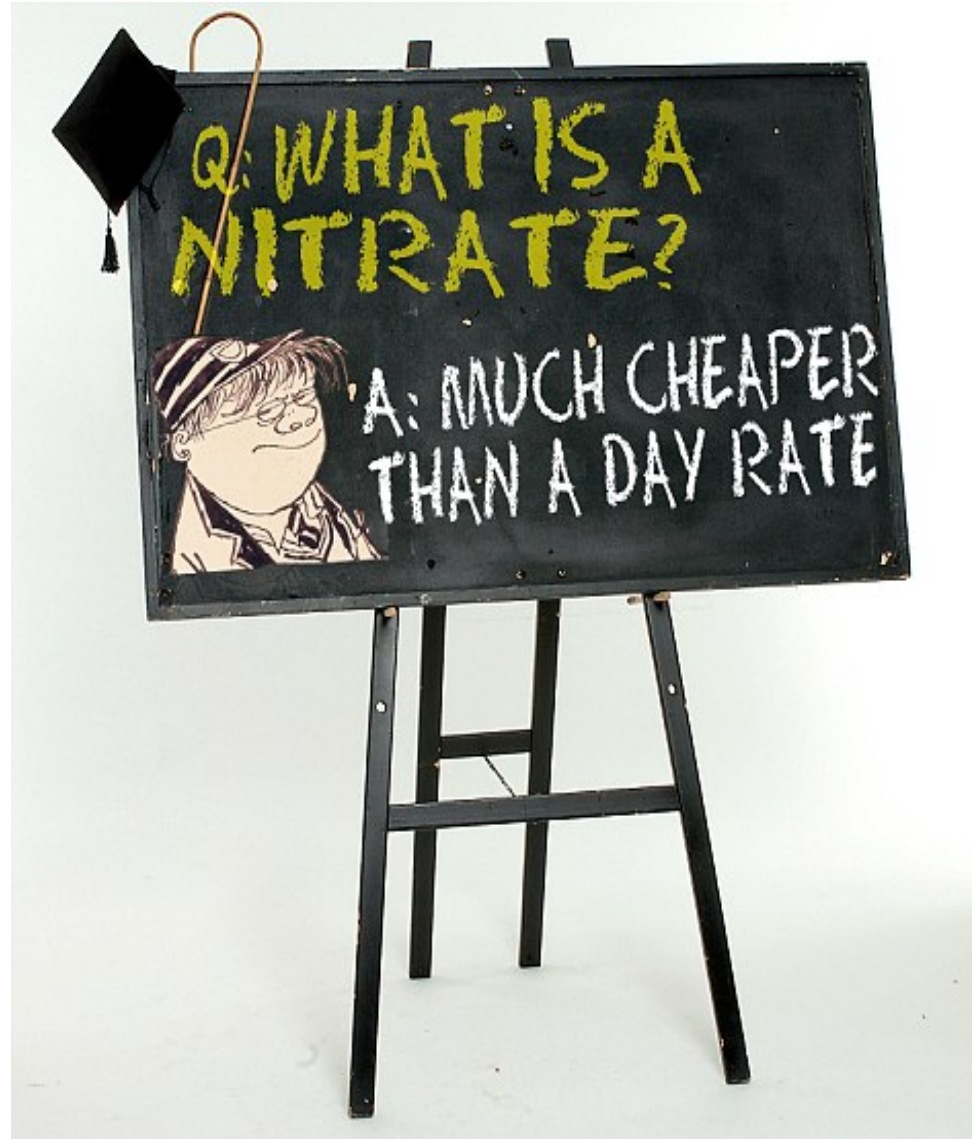
# Specific issues in the Rotorua lakes



Is it Swamp Thing?



Is it Climate Change?



At the risk of having to spell it out...

**IT'S THE NUTRIENTS**



Action folks!!!





Photo: Andy Buere





Photo: Andy Buere



# Restoration of Lake Kaituna



Photo: James Sukias (NIWA)



Photo: Monica Turner (Landcare)

**Drain interception with zeolite filter**

**Selecting appropriate plants for  
constructed wetland treatment  
(Andrew Hayes)**





Lake Kaituna

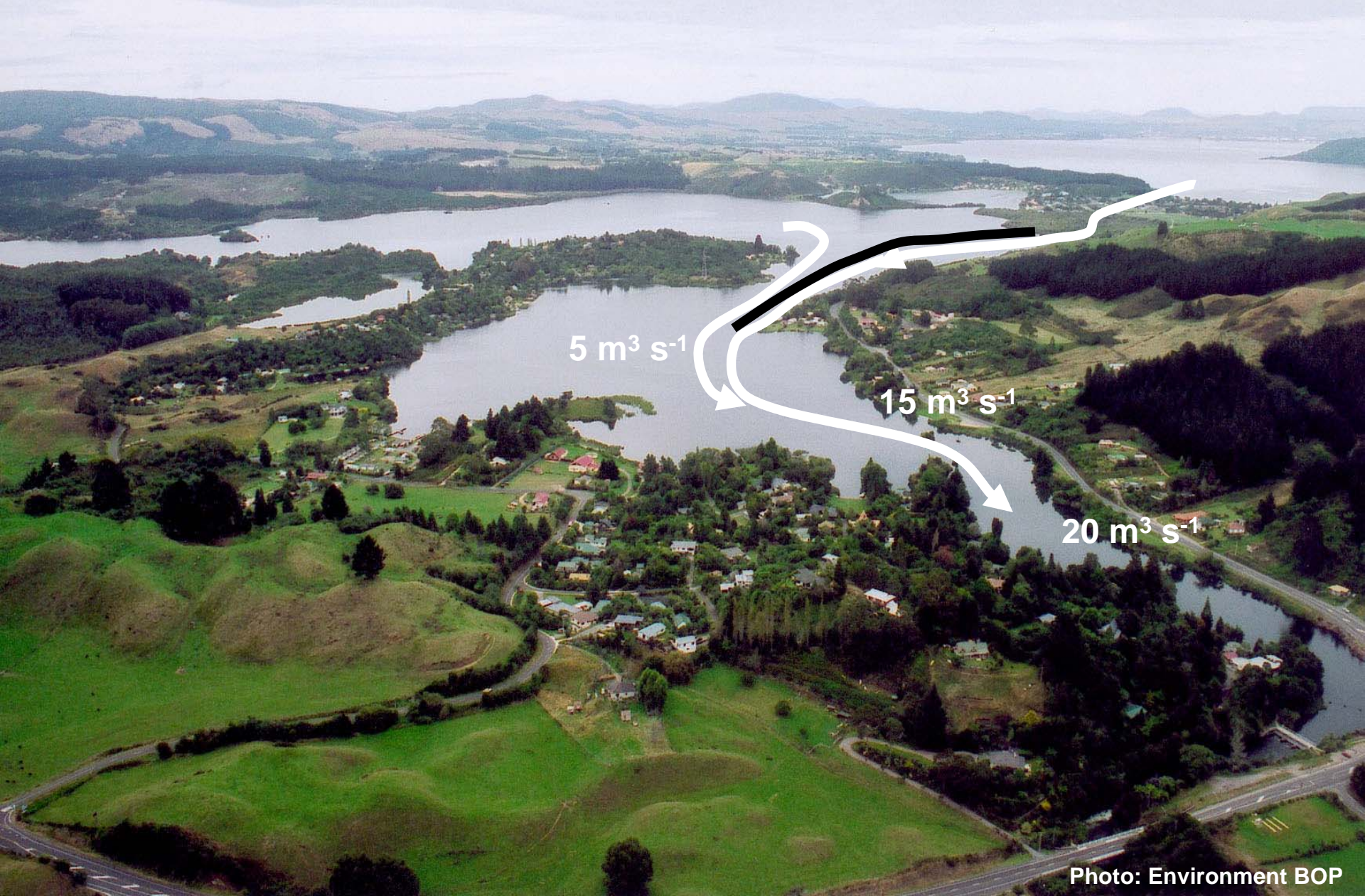


**Sedimentation basin, Lake Kaituna**

Photo: Monica Turner

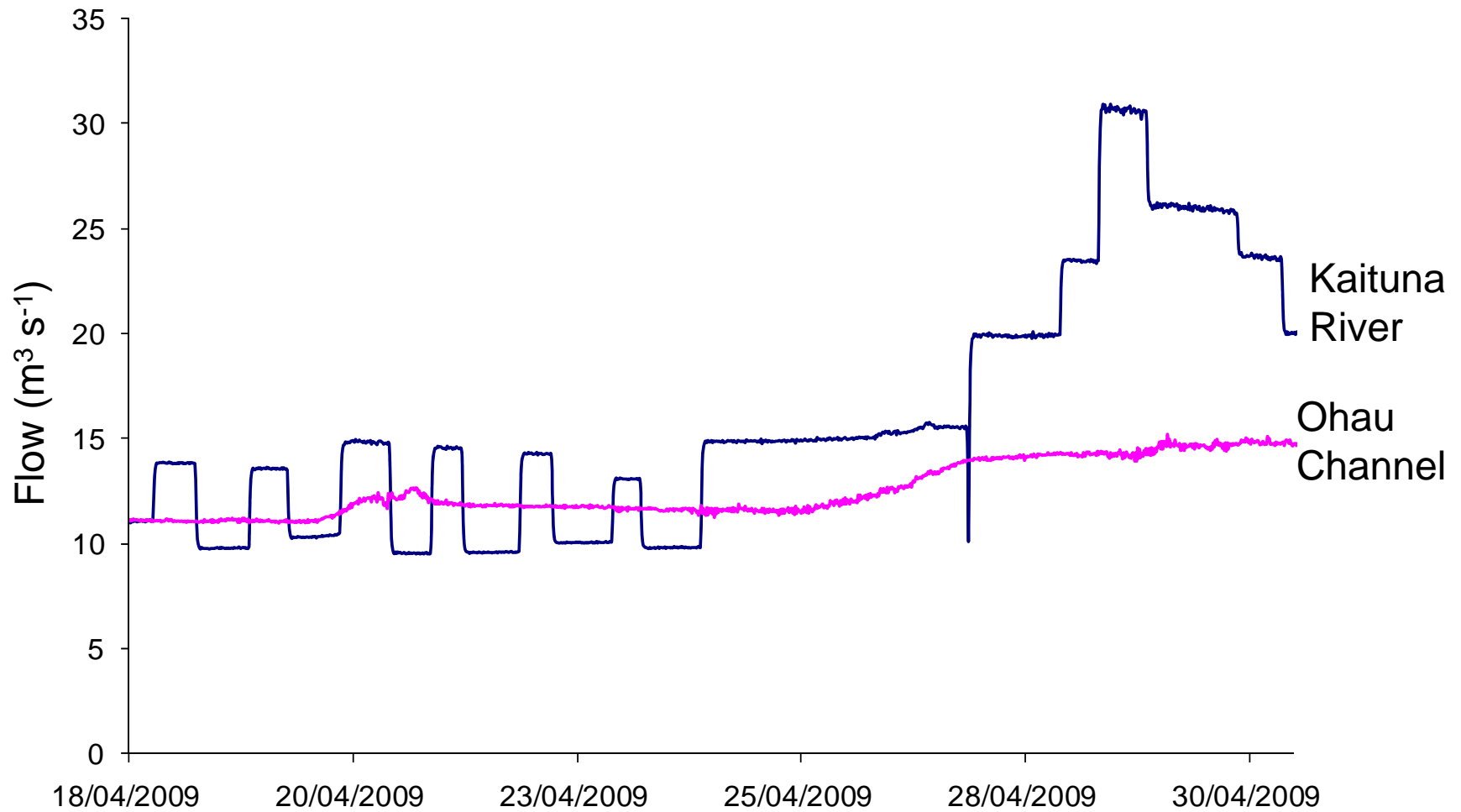


# The general case of Ohau Channel and Kaituna River flow





# Flow in the Kaituna River and Ohau Channel, 2004



# Filling Lake Rotoiti rapidly – the case for backflow





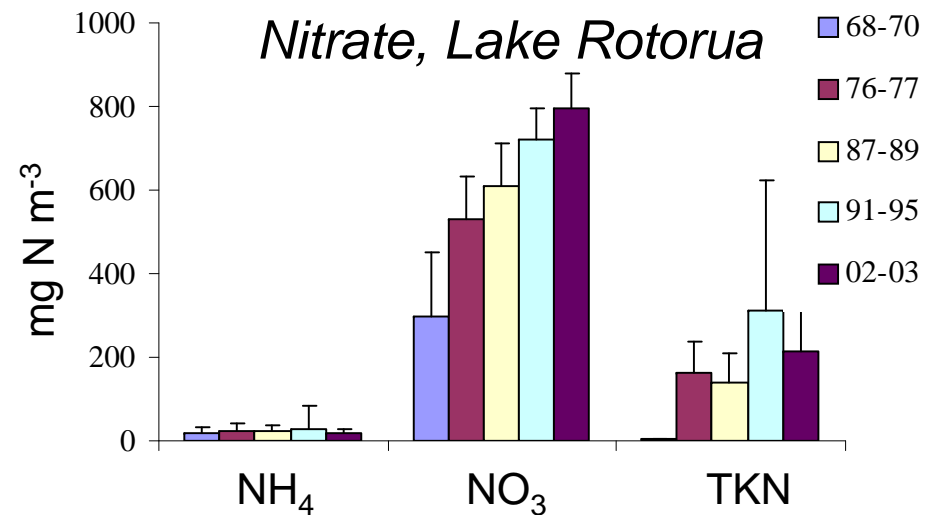
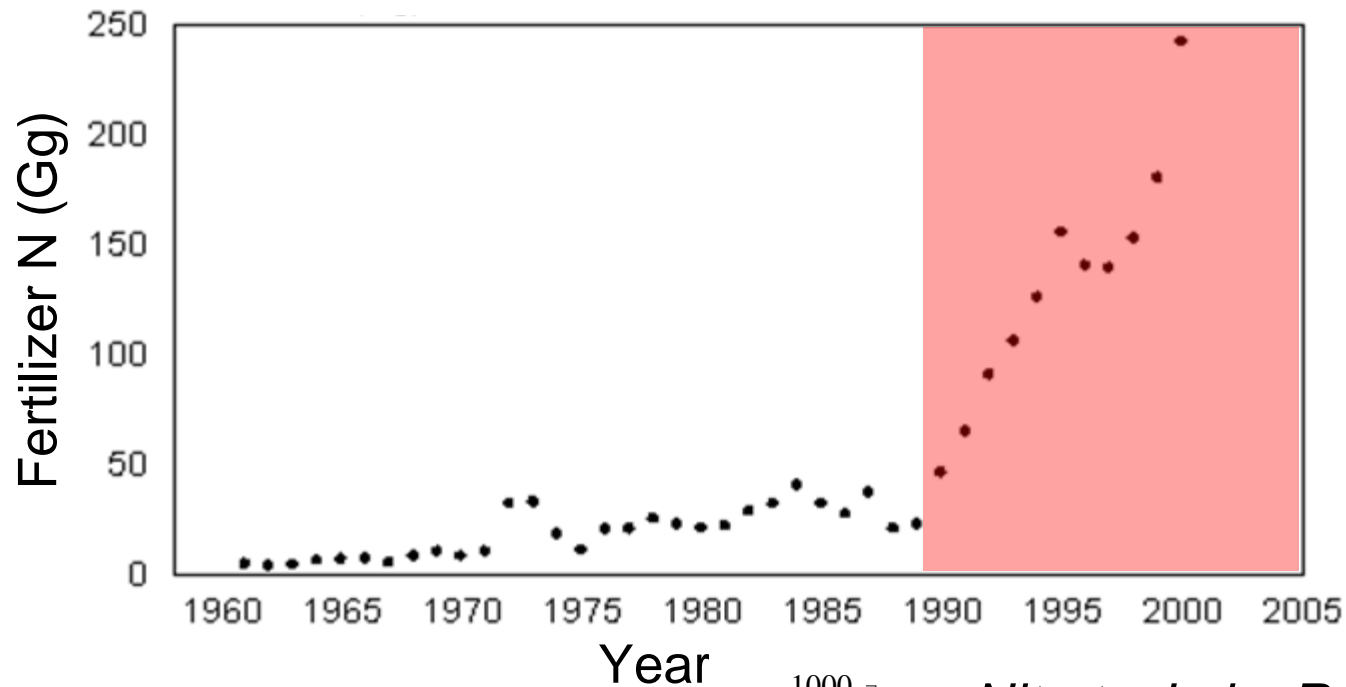


**Rotorua State Highway 30**



**Lower Waitaki Valley**

# Urea fertiliser sold in New Zealand



# The final word...

“Delay and denial have been endemic in the history of environmental law...what the world is suffering is not a lack of science or law, but a lack of environmental urgency”

“In the face of the literally life-threatening environmental crisis, such discretion [of environmental laws] is naive at best and suicidal at worst”

Professor Klaus Bosselmann, Centre for  
Environmental Law, University of Auckland  
(Otago Daily Times 14 Jan. 2010)

“David Orr doesn’t buy the idea that the public can handle only happy news. The public should be treated as intelligent adults who are capable of understanding the truth and acting creatively and courageously in the face of necessity.”

With reference to environmental educator  
David Orr’s new book







