Grassland farming and water quality in New Zealand

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Talk outline

- Overview of issues
  - Pastoral agriculture & intensification
  - Water quality and habitat impacts
- Management approaches
  - Legislation and non-regulatory
  - Industry self-management
  - Lake Taupo N cap and trade
- Mitigation toolbox

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NZ geography

- Area 268,000 km^2 (10% > UK)
  - Forest cover was 85%
  - Grassland now 42% (11M ha)
  - 4.2M people, 85% in 1% urban land
- Temperate island climate
  - Ann temp 9-15°C
  - Rainfall: 0.4-10 m, mostly 0.8 – 1.5m
    - west-east gradient
    - Rain spread through year
  - Stock graze pastures year-round

Agric & Water = vital to NZ

- Agr = 49% exports
  - Clean-green image adds value
- Tourism: “100% pure NZ”
  - 18% foreign exchange earnings
  - Water = centrepiece of top tourist locations
- Water
  - quality is top public environmental concern
  - key resource for Maori who have incr. role in resource mgmt

NZ has a wealth of freshwaters

- 245,000 km streams & rivers
- 229 lakes > 50 ha
  - High rec. values
- Public ownership

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NZ agricultural history

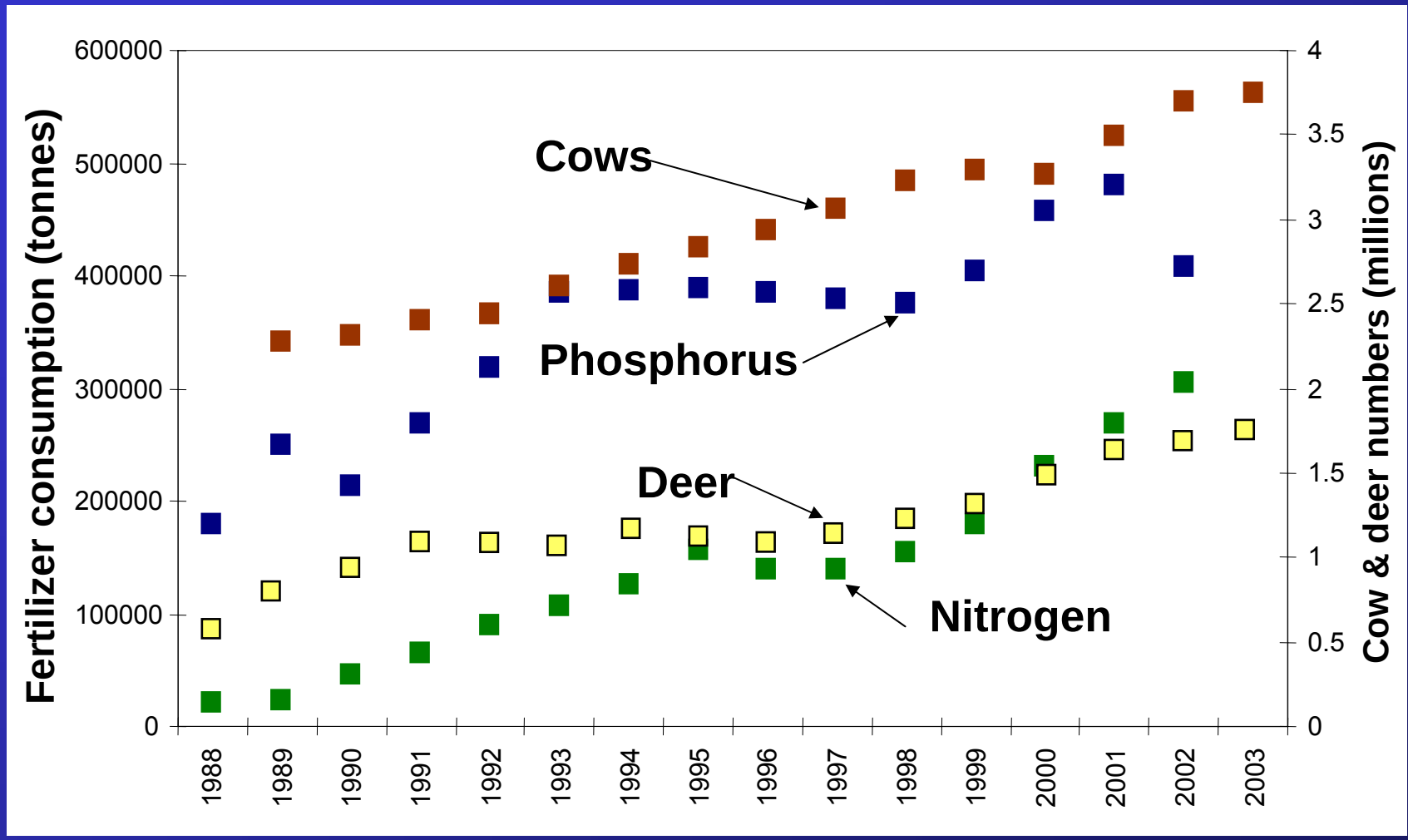
- 1840's grazing began
- 1865: 9 M sheep
- 1882: Refrigerated exports, NZ = "England's farm"

- 1920-70: *1st phase intensification* ↑150% stock

- 1980: 70M sheep, 8M cattle, deer farming
- 1984: No subsidies (=1% c.f. 34% in EU)

- 1990-2008: *2nd phase of intensification*
  - Sheep/beef farms: 11 → 8.8 M ha
  - Dairy farms: 0.89 → 1.4 M ha; 2.4 → 2.8 cow/ha
    - Dairy into dry (irrigated) and wet (drained) areas

Intensification pressures on freshwaters



Data source: Fertilizer consumption – UN Food & Agriculture Organisation
Cows –Livestock Improvement NZ Dairy Statistics

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Intensive agriculture - Higher nutrient inputs & losses

MAF Monitor Farms models - N leaching

- Sheep/beef 8 kg N/ha/y
- Deer 12 kg N/ha/y
- Dairy 38 kg N/ha/y

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Agriculture's multiple stresses on water

- Nutrients (N & P)
  - Algal blooms
- Pathogens
  - Contact & Drinking
- Sediment
  - Clarity
  - Sedimentation
- Agrichemicals
- Riparian habitat loss
  - Food webs, temp
- Flow & flow regimes
  - Habitat

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State of lowland pastoral stream water quality

- 259 low elev. sites 1999-2002
- Pasture sites degraded c.f. forest
- Median pasture values
  - Meet water clarity WQ guidelines
  - Fail DRP, NO_x-N and E. coli WQ guidelines

Larned, S.T. et al. (2004). *NZ J. Marine & Freshwater Res. 38*: 347-366.

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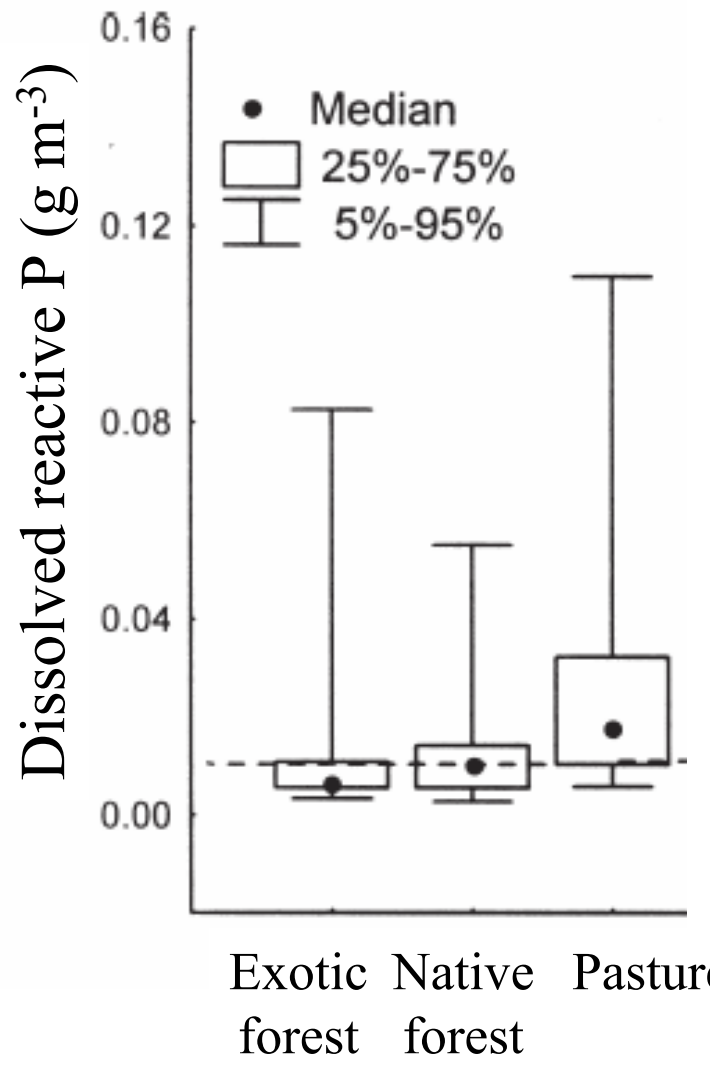
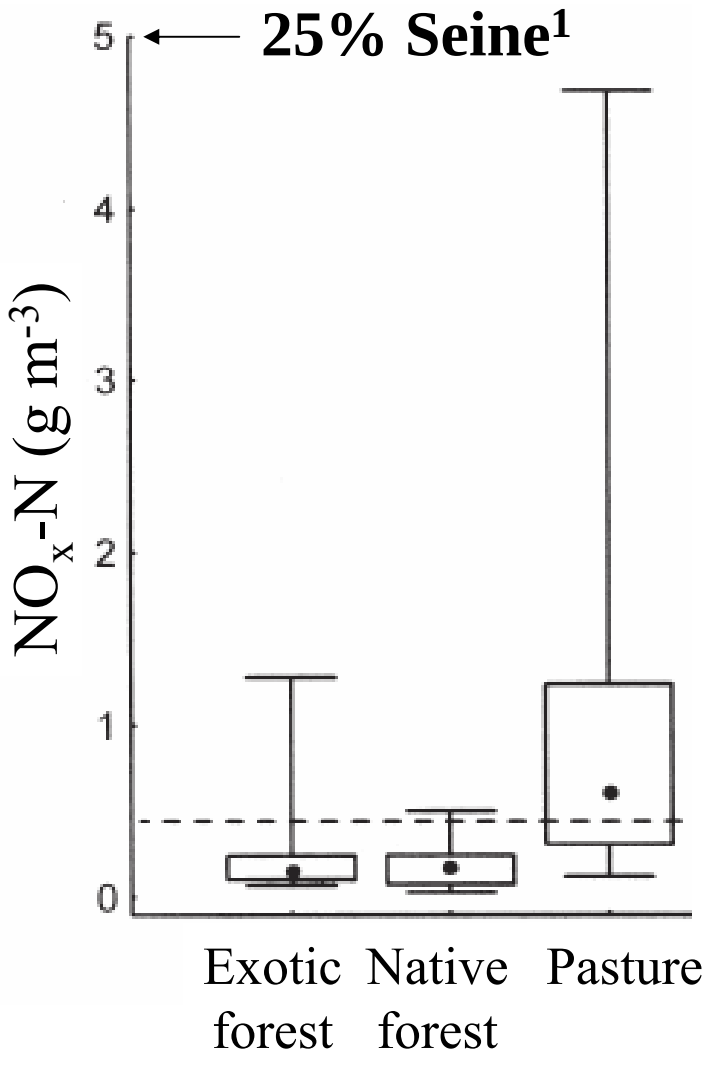
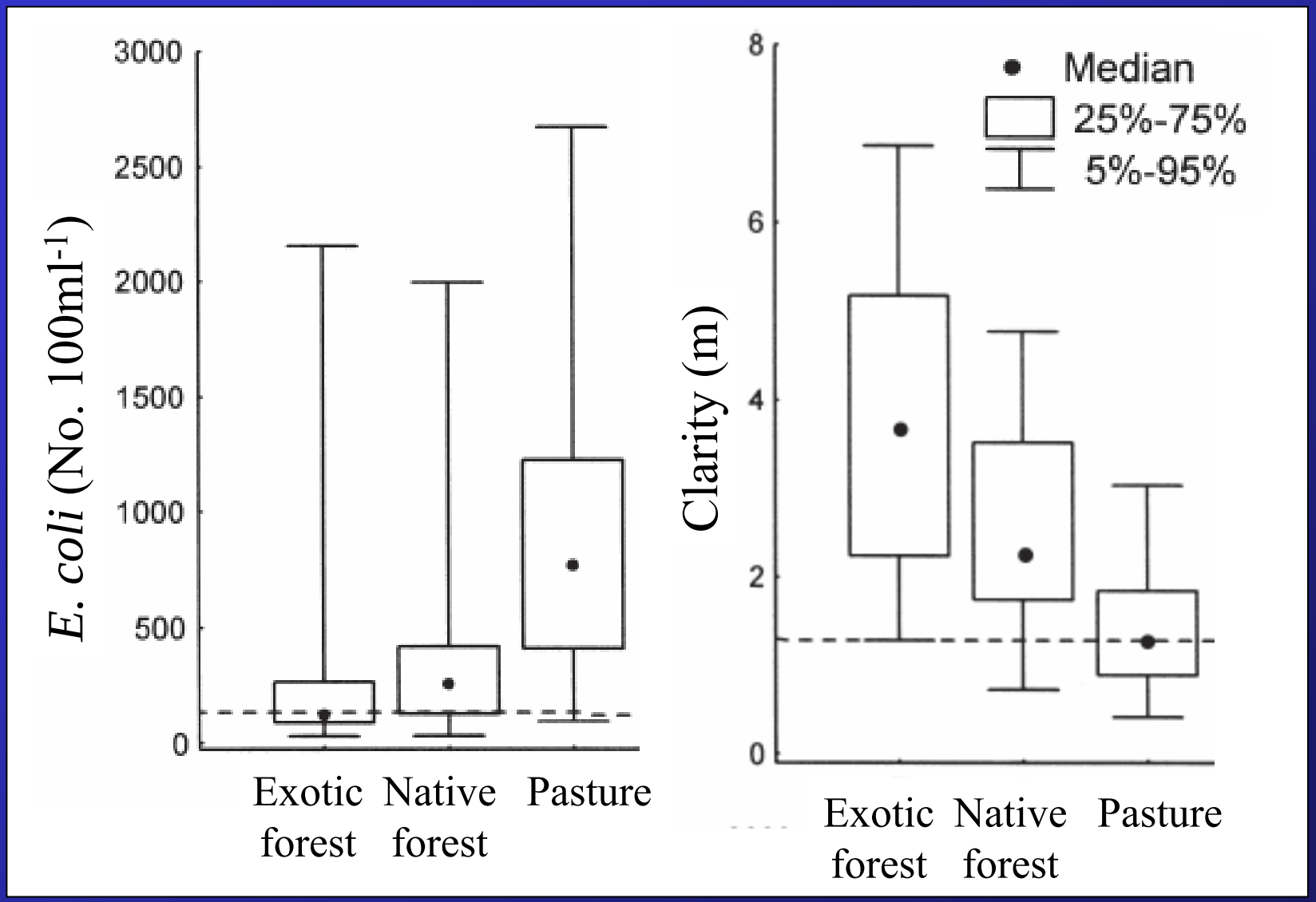
Nutrients DRP and NO_x





[1]Meybeck (2005)

Contact recreation



Larned, S.T. et al. (2004). *NZ J. Marine & Freshwater Res. 38*: 347-366.

Trends: pastoral intensification & stream water quality

- Southland 1990-1999 (cows up 6-fold)
  - DRP and NO_x-N up; Dissolved oxygen down[1]
- Waikato 1987-2002[2] (cows up 37% 1992-02)[3]
  - TN up 4%/y & TP up 2.5%/y
- Rivers Network 1989-2005
  - TN and DRP up for enriched sites (80%ile data)[4]

[1]Hamill, K.D., McBride, G.B. (2003). NZJFR 37, 323-332.

[2]Vant & Smith (2004). Env Waikato Tech Rep 2004/02.

[3]MFE (2003). TR130, 168 p.

[4]Scarsbrook, M.J. (2006). MFE report, 42 p.

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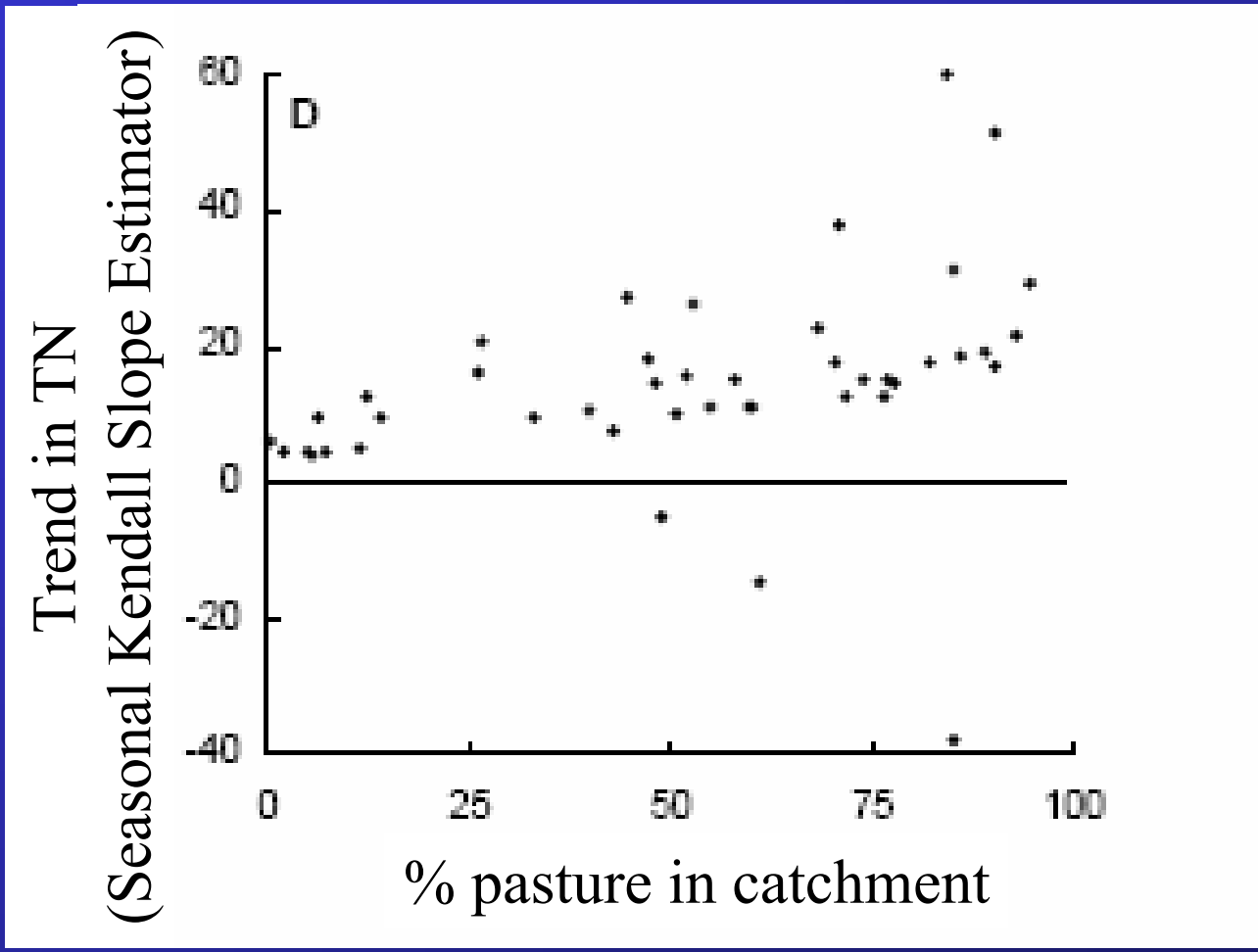
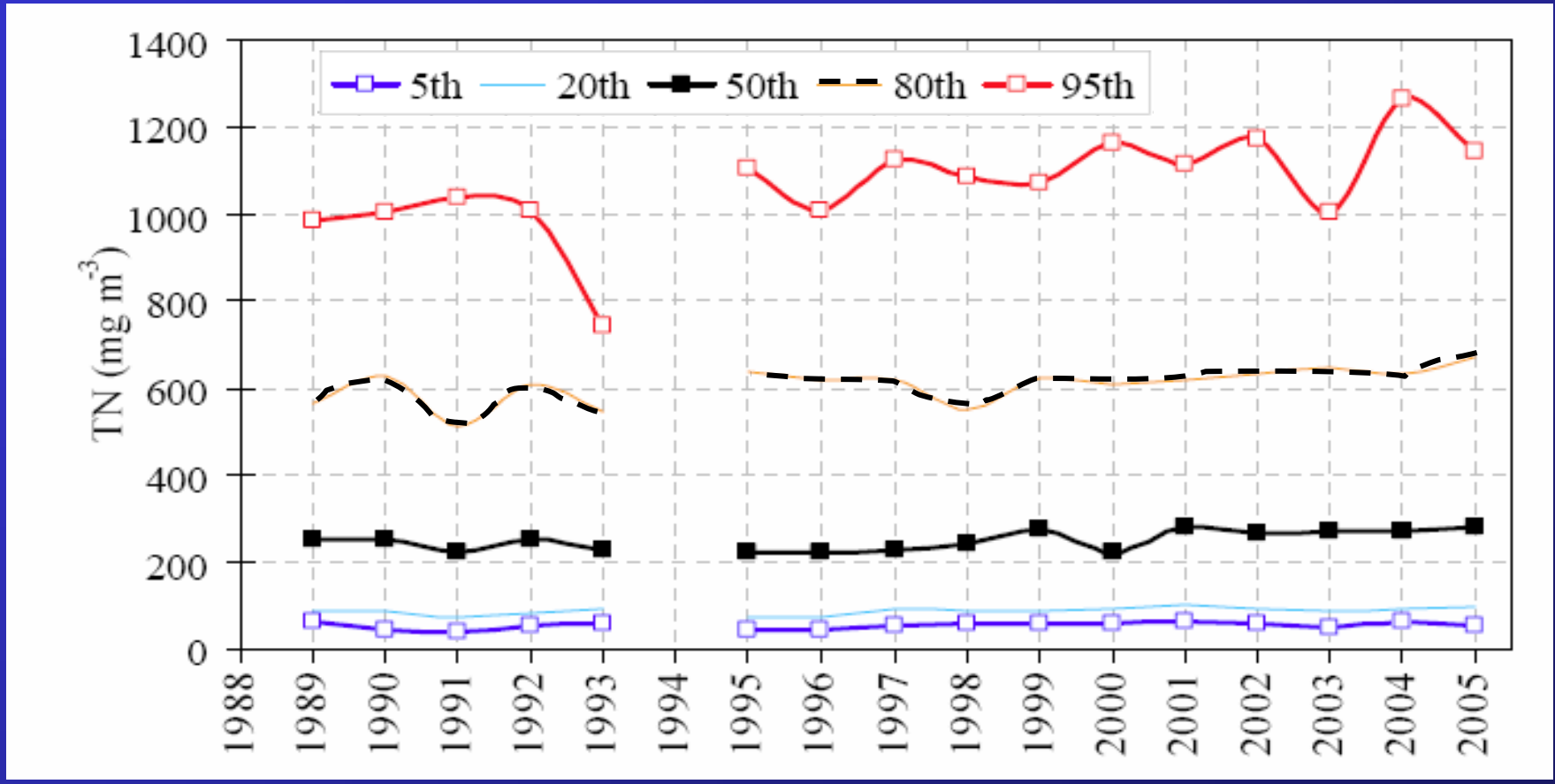
Waikato 1987-2002: TN trend strength up with % pasture



Vant & Smith 2004 EW Tech Rep 2004/02

National trends 77 rivers: "rich getting richer"



Scarsbrook, M.J. (2006). MFE report, 42 p.

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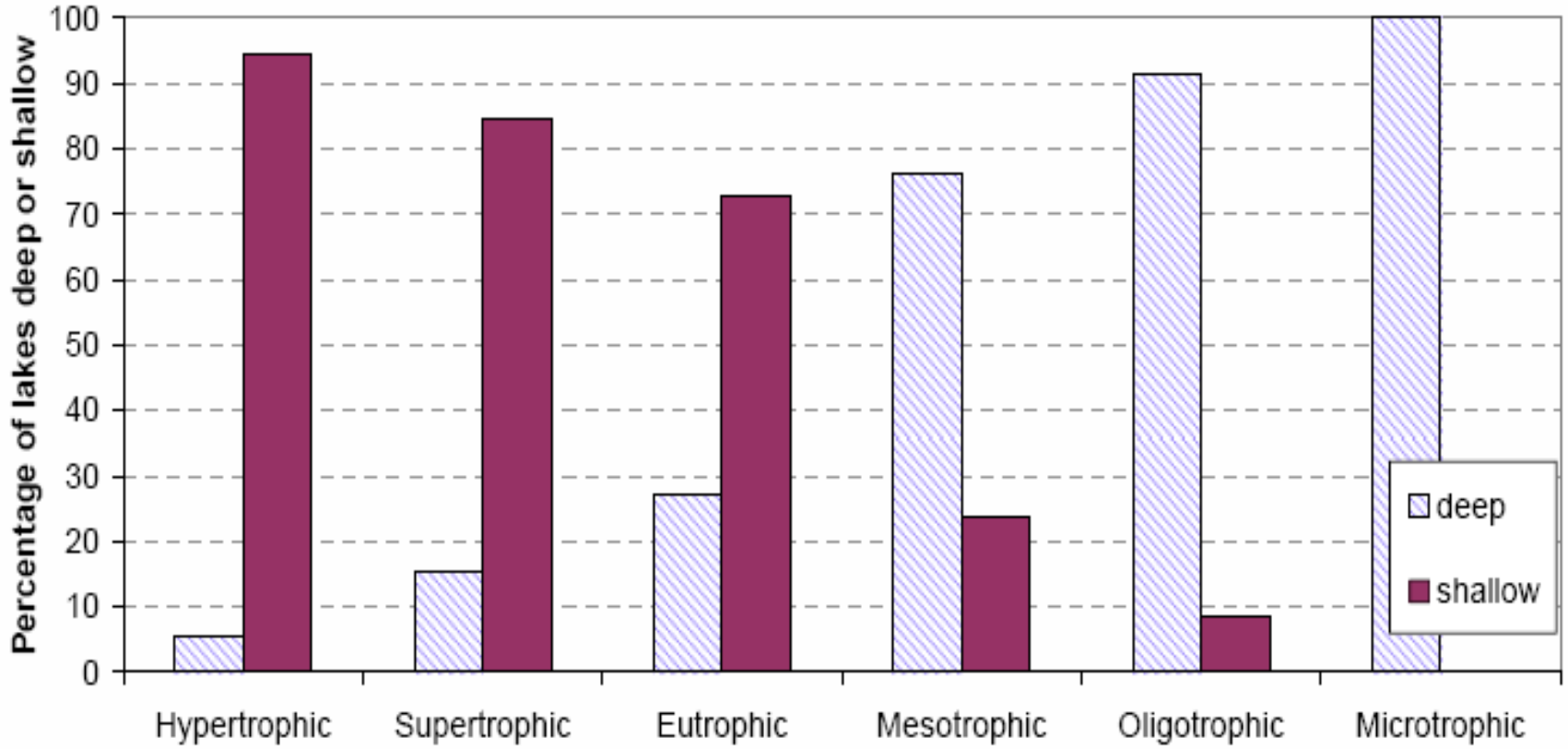
Grazing & stream habitat

- Riparian deforestation
  - NZ h/w streams were naturally shaded
  - Pasture homogenises
    - all unshaded, warmer, lack litter input
  - ↓ biodiversity at catchment scale
- Can be reversed by riparian reforestation

- Abstraction and deforestation
  - alter flow regimes & habitat
- Dams and culverts
  - affect fish and invert migration

State of our lakes

- >50% 134 monitored lakes ≥eutrophic
- Most shallow (<10 m deep) ≥ eutrophic



MFE (2006). Snapshot of lake water quality in New Zealand. ME776, 53 p.

Trends in ecological condition (LakeSPI, 46 lakes)

- 48% declining; 22% improving
- Pressures
  - invasive plants & fish
  - loads of sediment and nutrients
- Several iconic lakes under pressure from N & P with pasture a key source

MFE (2006). Snapshot of lake water quality in New Zealand. ME776, 53 p.

Managing the tension: Agricultural and water quality, a complex problem

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Sticks & carrots, Govt & industry

- Resource Management Act (RMA) 1991
  - Goal = sustainable resource mgmt
  - Promotes effects-based approaches
    - Most standards narrative
  - Planning & decisions devolved to 16 Regional Councils
- Biodiversity Management
  - RMA + Conservation Act (1987) admin Dept of Conservation
- Industry driven codes & partnerships
  - e.g., Dairying and Clean Streams Accord

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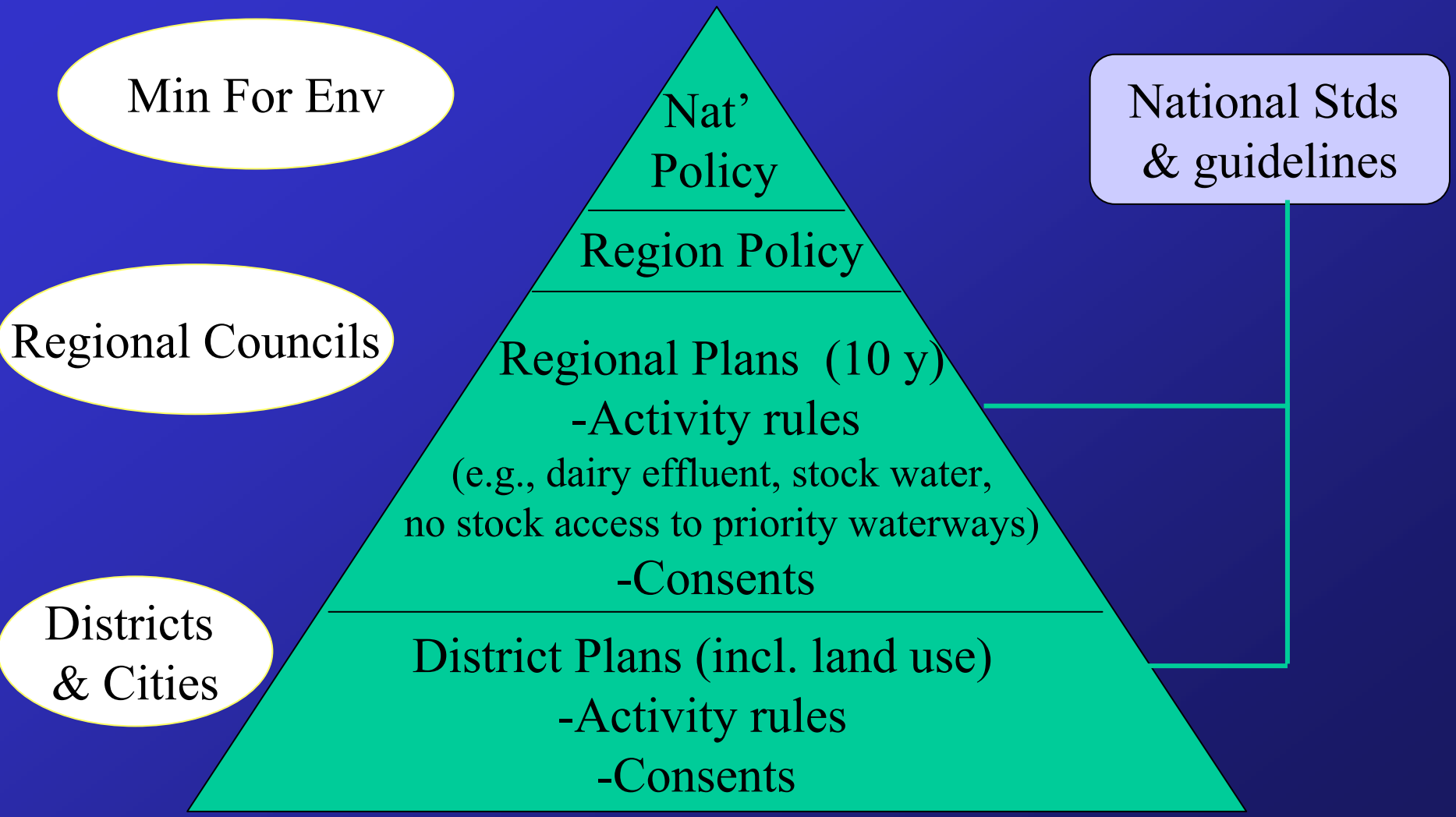
RMA hierarchy of plans



After EDS (2008)

Proposed National Freshwater Policy Statement

- Draft released Aug 2008, under discussion
  - Response to concerns that RMA not adequately protecting water quality & quantity
- Signals Ministry for Environment wants
  - More coordinated and consistent approach
  - More control of land use
- Goal: Improve integrated water management & water quality
  - FW swimmable by 2035
  - Effective standards in regional plans

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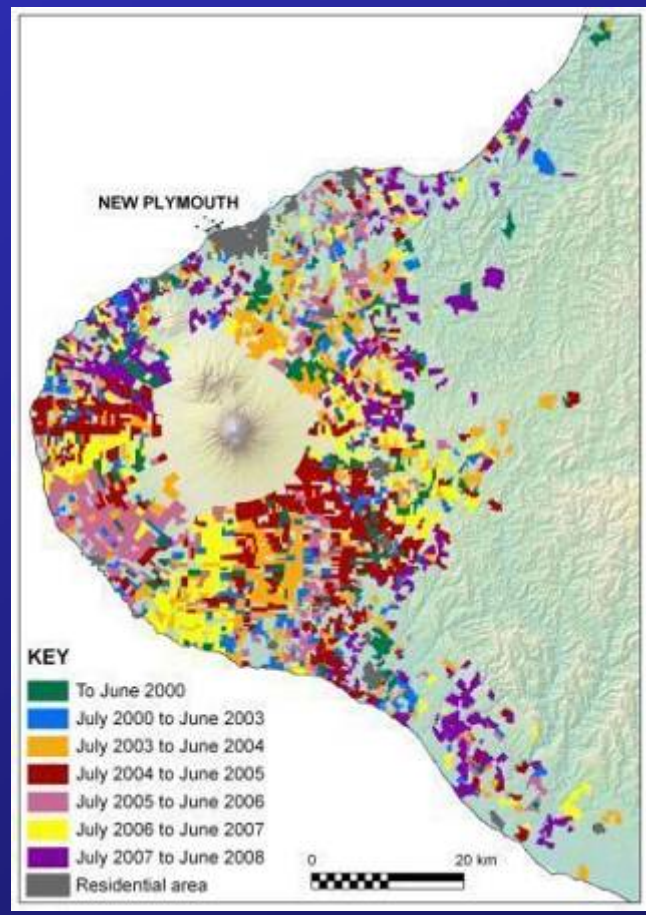
Non-regulatory tools favoured for diffuse source pollution

- Regional councils:
  - Farm environmental and riparian plans
  - Riparian guidelines & incentives
    - some RCs, 30%-70% subsidies
    - some RCs - trees at cost to riparian plan holders
  - Education
    - Factsheets, field days, enviro-schools…
  - Land and streamcare groups

- Agricultural Industry
  - Codes of practice & Accords
  - DairyNZ Farm Enviro Walk: detailed checklist
  - Guidelines (e.g., treatment wetland designs)
  - Farm Environment Awards – positive role models

Taranaki RC Riparian Plans

- Cover 10,818 km streambank
- 1.5M plants at cost
- 504 km stream fenced
- 425 km revegetated
- Likely contributed to ecol benefits
  - Stream Macroinvert Comm Index
    - 1995-2007 51 streams
    - 17 Positive trends
    - No Negative trends



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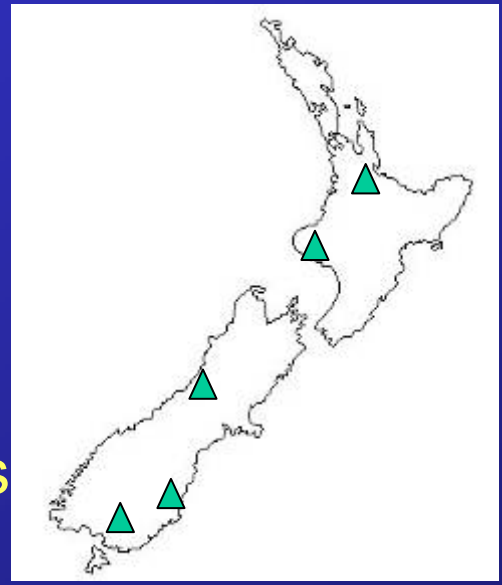
"Dairying & Clean Streams accord"¥

- Fonterra Coop Ltd & Central & Regional Govt
- Requires Fonterra suppliers (90% of 11,630 farms):
  - 90% streams (> 1 m wide) fenced by 2012
    - 83% compliant in 2006/07Φ (farmer self-reporting)
  - 90% regular stock stream crossings bridged by 2012
    - 97% compliant in 2006/07Φ
  - All dairy milking shed effluent meets Regional Council compliance immediately (2003)
    - 93% compliant in 2006/07Φ
  - All farms complete nutrient budgets by 2007
    - 64% compliant in 2006/07Φ

¥ http://www.mfe.govt.nz/issues/land/rural/dairying-accord-may03.pdf

ΦMFE (2007). The dairying and clean streams accord: snapshot of progress 2006/07.

Dairy Catchments study



- 5 contrasting catchments
  - Best Management Practice (BMP) effects
  - $ & social aspects of uptake
- N, P, SS & E. coli typically 2-10 X guidelines
- But WQ and habitat improving
  - Fewer point source discharges of dairy shed eff.
  - Better riparian mgmt (fencing & planting)
  - Better nutrient budgeting

Wilcock et al 2006 NZJMFR 40, 123-140
Wilcock et al 2008 NZJMFR (in press)

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Mitigation toolbox

- Clean Streams Accord = good start
  - But more likely to be needed
- Mitigation tools being dev linking
  - Aquatic values (key stressors & targets?)
  - Contaminant flowpaths
  - Cost-effective mitigations researched
    - Farm innovation:
      - Grazing, low N feeds, nutrients, nitrification inhibitors, effluent treatment & irrigation, drainage, irrigation outwash….
    - wetlands, filter strips, riparian buffers….
  - Tool application modelled for typical farms in different regions

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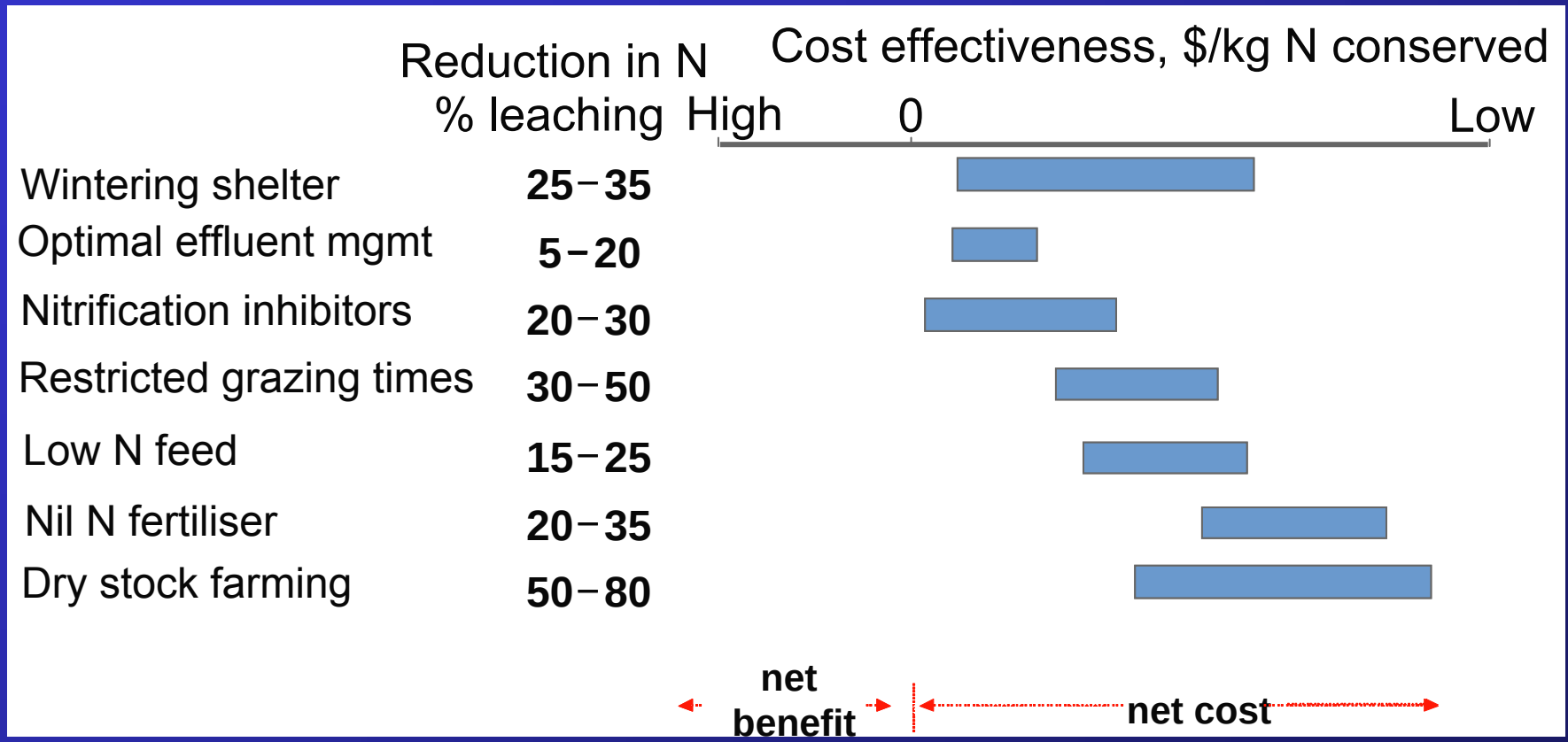
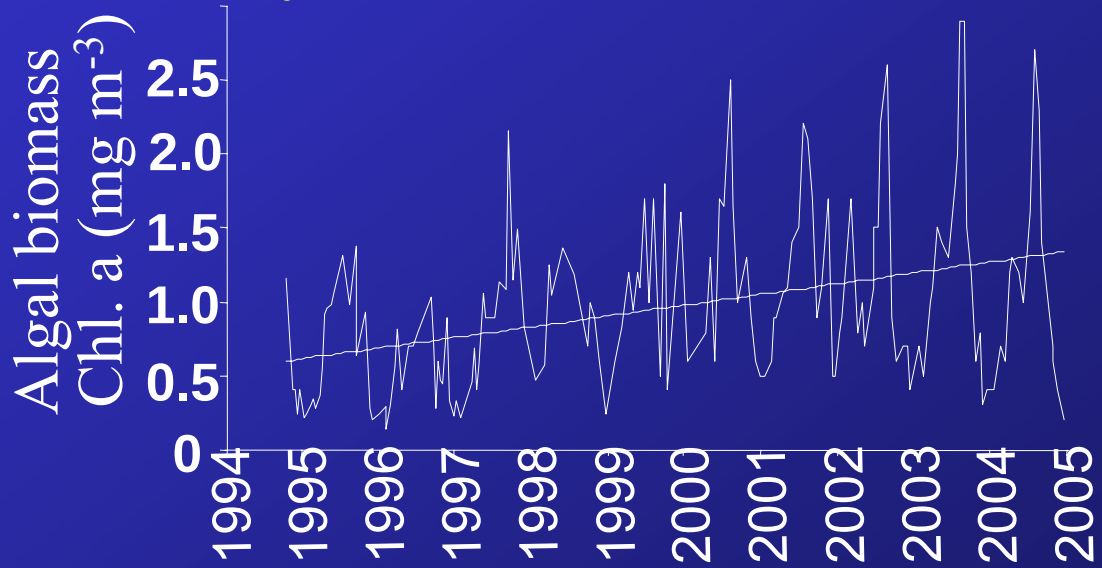
Toolbox output: e.g., N reduction for "typical" southern NZ dairy farm



Monaghan, R.M., et al. (2008). J Env Mgmt 87, 609-622.
Monaghan, R.M., at al. 2007 Fert & Lime Res Centr Occ Rep 20: 25-36.

Lake Taupo - Issues

- Iconic NZ lake
  - Largest (63 km^2)
  - clarity 16 m, but declining
  - 18% catchment pastoral, since 70s
  - Phytoplankton N-limited
  - Grassland farms = 37% of N inflow
  - Dairy conversions proposed 2000



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Taupo N Cap and Trade

- Target = 20% ↓ manageable N in 15 y
  - 8% of N load, calc. to keep current clarity
- Trust established with $82.5M funds
  - Buy N off land owners; Support research to lower N losses; Manage N trading
- Individual landowners
  - Need Consent from RC to farm
  - 2001-05 leaching = N Discharge Allowance
  - *Overseer*™ models farm N budget & leaching

Conclusions

- Agr & water quality vital for NZ culture & $
  - **But** ongoing Agric intensification = key driver of WQ degradation → complex problem!
  - Sustainable solution = key national challenge
- Govt levers: RMA Plan rules and consents, education, incentives
  - Some success but WQ decline often continuing
- Industry driven Clean Streams Accord
  - Progress with core BMPs on dairy farms
  - Monitoring to determine adequacy

Future

- More agriculture impact controls to meet goals of draft National Policy Statement?
  - Land use limits, N &/or P or sediment trading in sensitive catchments, more riparian mgmt
- Ongoing innovation
  - farmers, govt and interdisciplinary science
  - maintain NZ as “clean-green producer”

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Thanks for listening

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