National Environmental Research Program

LANDSCAPES & POLICY hub

In the Tasmanian Midlands, approximately 80% of land is in dryland production and 7% is under irrigation.Photo: Suzie Gaynor

Water management tools to explore irrigation and conservation

- We built a bioeconomic model to explore the relationships among the hydrological, ecological and economic drivers of irrigation development in the Midlands.
- We used the model to examine and compare future scenarios of water use, land use, environmental values and climate change on the economic returns of irrigation.
- The model outputs provide a means for irrigators, water managers and policy-makers to explore the economic consequences of irrigation and conservation scenarios.

Research summary

We developed a bioeconomic model of water use for the Tasmanian Midlands to explore the impacts of the hydrological, ecological and economic drivers on the regional economy.

With the commissioning of the new Midlands Water Scheme, land use is expected to change. We built a bioeconomic model to examine and compare future scenarios of water use, land use, environmental values and climate change. The model explores the influence of these factors on economic returns at a sub-regional scale.

We also identified the management tools most likely to promote collaboration among irrigators in meeting cease-to-take targets and sharing a common resource. Together, our findings provide a means for irrigators, water managers and policy-makers to explore the economic consequences of irrigation and conservation scenarios.

The Tasmanian Midlands - a case study

We focused our research on the part of the Macquarie River within the Midlands Irrigation Scheme, including the districts of Tunbridge, Ross and Campbell Town, an area covering around 185,000 ha.

Every parcel of land and hectare of arable land within the study area was identified. This area was further sub-divided into eight sub-regions based on major tributary catchment and property boundaries.

The model we developed

The model is a linked economic and hydrologic model The economic component is a Generalised Algebraic Model (GAM), while the hydrologic component is based on the Climate Futures for Tasmania outputs of the greater Esk Basin.

The model is designed to reflect how water moves through the catchment, where it is extracted, and how much is required to grow the current and proposed future range of crops, the latter based on the Department of Primary Industries, Parks, Water and Environment's crop suitability modelling.

Grapes is one crop likely to expand with new water.

Photo: Suzie Gaynor

The scenarios we used

The model was set up to run three broad classes of land-use change scenarios, with six land use variants in each giving a total of 18 land use scenarios;

1. increased area of irrigated cropping using the existing suite of crops,
2. the same area of irrigated land with an increased diversity of crops and
3. increased irrigated area with an increased diversity of crops.

The current suite of land uses are dryland wool, lamb and beef production, plus irrigated dairy pasture, barley, wheat, other cereals, lucerne, poppies, potatoes, cherries and canola. The new irrigated crops included in the model are ryegrass, wine, olives, hazelnuts, blueberries, raspberries, carrots, carrot seed, hemp and pyrethrum.

The effects of applying land use constraints to conserve freshwater ecological values (as described in the CFEV - Conservation of Freshwater Ecosystems Values Database) were examined through a further nine scenarios, each examining the influence on economic returns of protecting the following values: currently reserved area, physical aquatic refugia, potential aquatic refugia, special values (threatened species), fish, invertebrate assemblages, native riparian vegetation, macrophyte assemblages, and overall naturalness.

All scenarios were run under current hydrology and projected 'extreme' climate hydrology, based on the driest outputs from downscaling six different global climate models for Tasmania. The scenarios were run for full water allocations and for high-security allocations only.

Preliminary results

- The benefits of irrigation to the regional economy varies by a factor of four across the 18 land use scenarios.
- Increasing the area under irrigation with the current set of land uses results in economic returns increasing up to 40%.
- Increasing the diversity of crops within the current area of irrigated land also increases the economic returns up to 40%.
- Increasing both area under irrigation and diversity of land uses within the amount of available water under all irrigation water (approximately 120,000 ML) increases the benefits to the regional economy by a further 300% (approximately).
- Under the current land use scenario, approximately 80% is in dryland production and 7% under irrigation, but irrigation contributes nearly half of the region's economy.
- Under the most productive of the 18 future land use scenarios, 44% is dryland and 43% irrigated.
- The model is capable of determining the contribution of the different irrigation schemes to the regional economy of the case study area (Blackman Irrigation Trust, Elizabeth-Macquarie Irrigation Trust, and Tasmanian Irrigation).
- The model is also capable of determining the relative contribution of different water sureties to the region's economy.
- The most profitable irrigated crops are blueberries and cherries.
- Projected future flows under Climate Futures for Tasmania climate scenarios have negligible effects on economic returns even for the driest scenario, however these flows have only been modelled at annual scales thus far. The effects of projected future flows are more likely to be seen at seasonal scales.
- The economic influence of land use constraints designed to protect ecological values varies depending on the values being protected. Little effect is observed when protecting physical refuges, broadwaters and special values but stronger economic implications are seen when protecting in-stream values such as fish and invertebrate assemblages.

Photo: Increasing the diversity of crops within the current area of irrigated land has the potential to increase economic returns up to 40%. **Photo: Suzie Gaynor**

Where to from here?

At present the model runs at fairly course scales, spatially at the sub-regional level and temporally, at the annual scale. We are constructing a second, finer-resolution model to explore economic returns at property and seasonal scales. We are continuing to liaise with land and water managers from the Department of Primary Industries, Parks, Water and Environment, NRM South and NRM North, the irrigation trusts and Tasmanian Irrigation.

We are also investigating the potential of developing a user-friendly interface for the model, so land and water managers can re-run the model as circumstances change and evolve with the new irrigation schemes.

Who are the researchers?

Prof John Tisdell

John leads the hub's Economic Futures team which is developing a conceptual landscape bioeconomic model and an associated experimental economics platform to evaluate policy options.

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Danielle is a freshwater ecologist at the University of Tasmania. She has worked in both research and management on the influence of land and water use on freshwater ecosystems. Her focus is on community ecology, environmental flows and water management

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Collaborators

Department of Primary Industries, Parks, Water and Environment (for future land use scenarios) and Tasmanian Irrigation (for projected future water use).

Further reading

West J (2009) *An Innovation Strategy for Tasmania*. Australian Innovation Research Centre, University of Tasmania.

Tasmanian Irrigation (2014) *Midlands Irrigation District: Overview Document*. Tasmanian Irrigation.

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DPIW (2009) *Environmental flows assessment for the Macquarie River catchment upstream of Lake River. Report No. WA 09/01*. Water Resources Division, Department of Primary Industries and Water, Hobart, Tasmania.

About the NERP Landscapes and Policy Hub

The Landscapes and Policy Hub is one of five research hubs funded by the National Environmental Research Program (NERP) for four years (2011–2014) to study biodiversity conservation.

We integrate ecology and social science to provide guidance for policymakers on planning and managing biodiversity at a regional scale. We develop tools, techniques and policy options to integrate biodiversity into regional-scale planning.

The University of Tasmania hosts the hub.

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