Step forward then look back

Uing 'backcasting' to improve conservation and offsets policy

By Ascelin Gordon (RMIT University)

Understanding the long-term impacts of different conservation policies is a massive challenge. For starters, there are long delays (potentially decades) between policy implementation and the resulting conservation gains or losses. And sometimes measuring those gains or losses can be difficult or even impossible because it's expensive to monitor outcomes at the large temporal and spatial scales required and thus adequate data are often unavailable for this purpose. Poorly defined objectives of a policy also often make it unclear as to what would be required to assess whether the policy objectives have been met. While all these issue are relevant to conservation policy in general, they are particularly relevant to one policy area with important conservation implications – biodiversity offsetting – because offsets tend to trade off permanent immediate impacts on biodiversity with uncertain future biodiversity gains.

Because of this these challenges, it can be difficult to work out how best to structure a new conservation policy, or refine an existing one. Researchers have suggested that scenario analysis, adaptive approaches and resilience thinking may all be useful tools in this context. I'd like to propose another approach – 'backcasting' – as a valuable means for improving conservation policy. Backcasting has been used in many fields such as energy policy and sustainable development (see the box 'A brief history and overview of backcasting'), but has rarely has been applied to the setting of targets in conservation. And in cases where it has, the applications have been of a qualitative nature.

Choose a future

So what is backcasting? It can be thought of as the opposite to forecasting. While forecasting is about predicting the likely future given current trends, backcasting is about choosing a future, and working out the multiple pathways to reach this future from our current state. Put simply, backcasting is about working out how to reach a future we want, rather then the forecasting approach of determining the futures that are most likely.

I recently demonstrated how the backcasting approach can be applied in setting quantitative conservation targets involving biodiversity offsets. To illustrate the value of the approach I explained how it might be used in a case study based on policy to manage the growth of Sydney into a threatened ecological woodland community (Gordon, 2015).

A brief history and overview of backcasting

'Backcasting' was first used as an alternative to forecasting in the early 1980s for developing energy policy. However the origins of backcasting go back further to the 1970s when Amory Lovins proposed a 'backwards-looking-analysis' to overcome difficulties in long-term energy forecasting. An interesting aspect of backcasting is that it is an explicitly normative approach in that it involves defining a desired future state as a target, and then determining multiple pathways to traverse from the current state to the future state. One of the strengths of the backcasting approach is that it is explicitly based on searching out multiple pathways to meet future objectives, and can thus encourage a broader view of relevant factors, leading to the systematic consideration of options that may not otherwise be considered 'feasible'.

The community in question is the 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' (which I'll refer to hereafter as the 'Cumberland Plains Woodlands'). This community is listed as critically endangered under the EPBC Act with less than 10% of its original pre-1750 extent remaining. (See the box 'Shadow of a once common woodland'.)

The woodlands face a range of issues. One major threat is pressure from urban development involving clearing to accommodate the growth of Sydney. Urban development inside two new nearby 'Growth Centres' is expected to eventually provide residential areas and employment opportunities for approximately 500,000 people! Other threats to the Cumberland Plains Woodlands include the legal and illegal clearing of vegetation on private land outside the Growth Centres, and declines in ecological condition of the community due to invasive plant species such as the African olive and African love grass.

Modelling the future

With help from NSW and Federal Government agencies, a model was developed to predict changes in the remaining area Cumberland Plains Woodlands over time in response to the most important processes affecting the threatened community. These comprise:

(i) declines in ecological condition from invasive species;

(ii) legal clearing for development;

(iii) illegal clearing for development; and

(iv) the implementation of biodiversity offsets to compensate for legal clearing of the woodlands.

Each of these processes was controlled by a parameter in the model. As a range of real-world policy interventions could alter the processes impacting the extent of the Cumberland Plains Woodlands, a policy based on limiting the loss of these woodlands could be characterized by these four model parameters.

To implement the backcasting process, a future target of retaining 60% of the current Cumberland Plains Woodland in 50 years' time was used. The backcasting analysis then involved running the model thousands of times and searching for all combinations of these policy parameters that would result in the extent of woodlands achieving or exceeding this target in 50 years from now.

Pick a pathway

Of the 11,616 combinations of policy parameter values investigated, 4,637 (or 40% of the combinations) met the backcasting target. The challenge was then working out how to present these 4,637 parameter combinations in a way that was meaningful for policy

> "Backcasting, as quantitatively implemented here, provides a structured way to explore the outcomes of offsets between different combinations of policy interventions that would allow desired future targets to be met."

development. This was achieved using a statistical technique from machine learning called a 'classification tree', which enabled the 4,637 combinations of policy parameters to be grouped into six general classes, or policy options, where each class represented similar implications for policy.

In other words, for the chosen target, the backcasting analysis resulted in six general policy options involving different combinations of interventions that impact on how the area of woodland changes over time. For example one policy option showed that if declines in ecological condition from invasive species could be kept low, and the rates of clearing (both legal and illegal) were not too high, then even a weak offset policy would allow the future target to be met.

In contrast, another option showed that as long as the offset policy is adequate (ie, offsets were large enough), and there were only small amounts of illegal clearing, the targets could be met even if little is done to control invasive species and there are large amounts of legal clearing.

Exploring outcomes

Thus backcasting, as quantitatively implemented here, provides a structured way to explore the outcomes between different combinations of policy interventions that would allow a desired future target to be met. The approach also allows policy makers to examine other factors such as the potential robustness to uncertainty of a given policy option, or the extent to which they foreclose future policy options (which is described in more detail in my paper).

For this particular case study, it appeared the most viable way of achieving the desired future target for the Cumberland Plains Woodlands was to ensure the offset policy is adequate (large enough offsets) and properly enforced (low rates of illegal clearing). If this was not feasible, the analysis shows that controlling invasive species provides the greatest potential for keeping other policy options open into the future.

While backcasting is not a panacea, I argue it provides a useful addition to the conservation policymaker's toolbox, providing a structured way to explore and develop a range of policy options that allow desired conservation targets to be met.

More info: Ascelin Gordon ascelin.gordon@rmit.edu.au

Reference

Gordon A (2015). Implementing backcasting for conservation: determining multiple policy pathways for retaining future targets of endangered woodlands in Sydney, Australia. *Biological Conservation* 181: 182–189. doi: 10.1016/j.biocon.2014.10.025

This information sheet is an extract from *Decision Point #91* (August 2015). If you would like to access the whole issue, please visit http://decision-point.com.au/

Shadow of a once common woodland

Before European settlement, the Sydney region was covered by a range of forest, woodland and heathland ecological communities. The Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest was the most common type of native vegetation in the area now occupied by western Sydney, including towns such as Blacktown, Campbelltown, Camden, Fairfield, Liverpool, Penrith, Richmond and Windsor.

As a consequence of clearing and weed invasion, the ecological community is now restricted to relatively small and fragmented bushland patches nestled among a largely urban to peri-urban environment. Less than 10% of its original pre-1750 extent remains.

The Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest has great importance in the landscape, being a key example of a coastal grassy woodland. It is nationally unique.

The preservation of woodland remnants, such as the ecological community, will contribute to native vegetation corridors that will improve quality of life as the area becomes increasingly urbanised. It will also help to maintain valuable connectivity among native vegetation remnants that are essential to retain the fauna that live or migrate through the region. For example, birds and bats, including some threatened species, use the ecological community to move from north to south through western Sydney and beyond, and from east to west across the Great Dividing Range to the coast, as seasons change.

More info: http://www.environment.gov.au/resource/cumberland-plain-shale-woodlands-and-shale-gravel-transition-forest

Kangaroos graze in a remnant of the once mighty Cumberland Plains Woodlands. (Photo by Penny Watson)