

Guiding rangelands into an uncertain future

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Abstract. The oncoming stream of biophysical and social changes facing the rangelands calls for an innovative mix of modifying existing uses and pursuing new ones to help transition into a social-ecological system more in tune with its new environment. In the face of rising uncertainty, trying to find some particular, optimal combination of management and policy to suit some assumed future environment can't work. A transformational change is needed. This does not mean getting to one new, particular kind of system. It has to be an ongoing process of exploring, learning and keeping options open, along the lines of the developing field of guided self-organisation.

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In a changing environment future states of a complex adaptive system, like the rangelands, are inherently unpredictable. The challenge is how to manage such systems into the future without negative and perhaps irreversible changes. There are two basic options. Assuming the current way of using the rangeland is still desirable and likely to remain so, the question is how to build the resilience of that state to cope with both known and unknown changes in the socioeconomic and biophysical environments. If the current system of rangeland use is deemed unsustainable or inappropriate, the question then is how to transform into a different kind of system.

Of the many uncertainties in the oncoming stream of biophysical and social changes I'll focus on three, as context for considering their implications for rangelands policy and management. In the biophysical domain the dominant one is atmospheric and climate change. There are others, like new diseases and rising antibiotic resistance in both animals and humans, but I'll leave them aside. In the socioeconomic environment the two I'll consider are the uncertainties and speed of change in the economic world, and in social preferences.

In the climate change area a start can be made by building on developments already underway. Two of them, cell grazing and agistment, address the growing disconnect between the spatial pattern and intensity of livestock grazing and the pattern of grass response to grazing and rainfall.

In many rangelands cell grazing clearly shows increased productivity and infiltration of water across the landscape and is now included under the banner of regenerative agriculture. It is based on judging when and where to move livestock among the cells, depending on the timing and amounts of rainfall in relation to when the cells were last grazed. In dry rangelands this doesn't work so well because the spatial scale of variability in rainfall and the size of cells required are too large. They don't fit with the rapid movements of livestock on which the system is based.

However, one system that does fit the larger dry rangeland scale, a kind of large-scale cell grazing, is agistment.

Agistment is a system of trusted arrangements between ranchers whose rainfall patterns differ in any one year, though on average they are the same or similar. It fits the spatial movements of livestock with the spatial scales at which rainfall and hence production varies in time, simulating the way herds of large herbivores co-evolved with rangelands in Africa. It works well in many regions and has been used for a long time in Australia.

As climate variability increases, could agistment be extended to some ranchers perhaps not even owning a ranch of their own but instead just owning herds of animals that are agisted on different properties? And conversely, could there be ranch owners who do not have their own livestock but rent out their grazing to different livestock owners? And graziers who own more than one property in different rainfall areas? Could some combination of these kinds of arrangements together with conventional ranching offer a diversity of options that would foster resilience in the whole, large scale system? Evolution of the socioeconomic system of ownership and use in response to climate changes?

The combined effects of increased CO₂ and projected increases in more intense, penetrating rainfall will lead to increased woody plant growth in most rangelands. A mix of grazers and browsers would increase the resilience of the grass layer. Such a mix persists only in African savannas, but what is the potential for re-developing it in Australia? (Australia's original mix of marsupial herbivores included large browsers). There are numerous examples of mixed cattle and sheep ranching; mostly keeping the flocks and herds separate as they are moved around, but they are both grazers, albeit in different ways. The only browsers used on rangelands are goats, and their use is increasing. Some two million were slaughtered in 2016, mostly

rounded up as feral animals, but it is progressing to controlled movements and harvesting using domestic varieties, in particular white bodied and Red Boer goats.

In the southern USA a group of rangeland scientists have considered ways to address the use of goats to deal with increased woodiness (Estell *et al.* 2012). In their words: '*A number of approaches are presently available (e.g. choosing appropriate species and breeds, providing dietary supplements and additives, behaviour modification, genetic selection) to increase shrub consumption.*' Exploring options like this in developing our goat problem / opportunity seems an obvious part of transitioning use and management of rangelands into their future environment.

Turning to the socioeconomic environment (SES), I'll again start with some changes happening already that could impact the rangelands. To begin with, the rise of alternative currencies. Long before the idea of blockchain, in Switzerland an alternative form of currency exchange, the WIR, has been operating since 1934 within a defined set of industries, as an electronic form of banking. Without any profit basis, it enables trusted exchanges advantaging the whole set. The system notes that 'while WIR is an abbreviation of a long German name, it also means 'we' in German, reminding participants that the economic circle is also a community'.

In the USA, 38 states each have several local, bitcoin-like currencies. California has 20. They are all local, trust-dependent community currencies.

The notable feature of all these currencies is that their use increases in times of financial difficulty.

Could something like this help the rangelands transition into the changing social and economic environment? Could a rangelands community currency/barter system, including agistment arrangements and new uses of rangelands – tourism, high-end specialised products - help transition the rangeland system into a different kind of SES that is more in tune with the changing physical, social and economic environment?

On the other side of this 'coin', there could arise the kind of 'Climate Clubs' arrangement proposed by Nordhaus (2015) in which groups of countries agree to put tariffs on countries that are free-riding on climate change. Livestock production of methane is considered a climate impact that should be paid for by countries emitting it. Climate Clubs would enable the member countries to act together without the need for international agreements to impose such a tariff. There is also growing support for the idea that those who consume 'emissions in meat' should pay the cost. I know the beef industry is aware of carbon neutrality and on track for achieving it. I am impressed with their Sustainability Framework. But many will not accept C-storage as a trade-off for methane emissions and will demand reduction. Kangaroos don't emit methane and, as also emphasised in this conference, there is a need for kangaroo management to be included as part of the overall grazing management (Wilson and Edwards 2019). Is this an area that warrants exploration, including the use of potentially browsing marsupials (black wallaroos include shrubs in their diet) using genetic selection and behaviour modification, along the lines of the goat work in the southern US?

Some social changes with very significant consequences are just in their infancy. One that stands out is a change in the demand

for meat. The world's first cultured meat hamburger was produced in The Netherlands in 2013 and it cost US\$325000. The company that produced it estimates that by 2021 it will cost about US\$11. There is a widespread and fast-growing change in social ethics in regard to eating animals. Many people dismiss this, saying that with the growing numbers and affluence of people in the world there'll always be a huge demand for meat. However, take a look at the website of Impossible Foods <https://impossiblefoods.com/>. Is it wise to not even consider it? Think about the tipping point that led to the now widespread disapproval of smoking in public. Yes, there is still a tobacco industry, largely now in the developing world, but the title of a 2016 article in *The Conversation* reads '*How smoking bans could lead to the death of the tobacco industry*'. Perhaps not death for the meat industry; but how sick might it get?

Concluding remarks

The linked biophysical, social and economic rangeland system is in disequilibrium with its changing natural and social environments. Climate change means the rangelands will no longer have just a fluctuating environment, but one that is largely unpredictable and with a trend, which calls for an ongoing process of learning and change.

The future social environment of the rangelands is equally unpredictable, not only in terms of changing ethics, preferences and economics, but because of completely unpredictable shocks such as the COVID-19 crisis. The ramifications of this global crisis are still playing out, but one forecast effect is likely to be a lessening of reliance on international supplies of essential goods and services. How will this affect the trade in livestock products? Expecting the unexpected and thereby enabling a rapid response to crises like this is an attribute that will become increasingly important in the rangelands.

In the face of the rising uncertainty in both the natural and social environment trying to find some particular, optimal combination of management and policy to suit some assumed future environment can't work. A more realistic approach in tune with an uncertain future is the developing field of guided self-organisation (Prokopenko 2013). Self-organisation, sometimes referred to as self-assembly, occurs in all kinds of complex systems. In social-ecological systems the trajectory of the system is determined by the external societal/environmental conditions. Guided self-organisation involves interventions to keep the system within defined bounds. It balances the aim of diversifying options in a self-organising way with the need to put some constraints on them.

The best way forward is allowing the system to evolve along a broad adaptive pathway, identifying and learning to avoid thresholds into undesirable (maladaptive) states while leaving all other futures open for testing. It is the basis of the Adaptive Pathways framework, as described in <https://research.csiro.au/eap/> and see also Wise *et al.* (2014).

The key to success in any program like this is helping to make it happen, rather than constraints. A good example is the model developed by the Dutch Research Institute for Transitioning (DRIFT - <https://drift.eur.nl/>). It began by helping to foster safe-fail experiments in all kinds of fields - agriculture, nature, social. Those that fail do not have damaging effects; those that show success grow and develop. It has grown into '...an institute for

research *on* and *for* sustainability transitions (with a) focus on opportunities for transformative change. We seek to envision and empower new futures within the ecological, social and economic boundaries that our societies face.'

Ranchers and farmers are among the most innovative people, and helping them come up with their own novel, safe-fail ways for the rangeland system to evolve makes a lot of sense.

There is no doubt that the uncertainty and degree of changes in the future social and biophysical environments in the rangelands will require transformational changes in the way they are used. Those affected can either choose to transform in ways that benefit them, or try to live in a system that will in any case be transformed. The big stumbling block in deliberate transformational change is accepting, in time, that it is necessary. The big challenge is getting those in charge of rangelands governance to understand two things:

- (i) Significant help will be required, from government and/or industry, and this means help *to* change rather than help *not to* change – to continue with what is not working.
- (ii) Transformational change in the rangelands does not mean getting to one new, particular kind of system. It is and will always be an ongoing process of exploring, learning and keeping options open.

Conflict of interest

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References

- Estell, R. E., Havstad, K. M., Cibils, A. F., Fredrickson, E. L., Anderson, D. M., Schrader, T. S., and James, D. K. (2012). Increasing shrub use by livestock in a world with less grass. *Rangeland Ecology and Management* **65**, 553–562. doi:[10.2111/REM-D-11-00124.1](https://doi.org/10.2111/REM-D-11-00124.1)
- Nordhaus, W. (2015). Climate clubs: overcoming free-riding in international climate policy. *The American Economic Review* **105**, 1339–1370. doi:[10.1257/aer.15000001](https://doi.org/10.1257/aer.15000001)
- Prokopenko, M. (Ed.) (2013). 'Guided Self-Organization: Inception.' (Springer-Verlag: Berlin, Heidelberg.)
- Wilson, G. R., and Edwards, M. (2019). Professional kangaroo population control leads to better animal welfare, conservation outcomes and avoids waste. *Australian Zoologist* **40**, 181–202. doi:[10.7882/az.2018.043](https://doi.org/10.7882/az.2018.043)
- Wise, R. M., Fazey, I., Stafford-Smith, M., Park, S. E., Eakin, H. C., Archer, E. R. M., Van Garderen, R., and Campbell, B. (2014). Reconceptualising adaptation to climate change as part of pathways of change and response. *Global Environmental Change* **28**, 325–336. doi:[10.1016/j.gloenvcha.2013.12.002](https://doi.org/10.1016/j.gloenvcha.2013.12.002)