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Frogs in agricultural landscapes

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TechnEcology and the video trap

I'm leading a research network called the TechnEcology Research Network. The network aims to generate a wildlife monitoring revolution that uses new technologies to understand more about where wildlife is in the landscape and how it's responding to the way we're managing it, and also engages the community and enhances their health and economic wellbeing.

One example is a video trap. Instead of using cameras triggered by sensors (particularly infra-red sensors that don't detect frogs and reptiles), we've built a trap that uses constant day/night video but has on-board smarts that allow us to delete video with no movement. It is customisable, so we can add sensors, and it could be terrestrial or aquatic. The system can detect where the animal is moving and, with a little bit more work, we'll be able to work out what species it is that's gone past. The other challenge is to automate individual recognition. If we can identify individuals in these sorts of videos, then there's capacity to do mark-recapture studies without ever marking an animal.

Biodiversity and the intensification of agriculture

We are in a period of massive global change where we see a close relationship between species extinctions and the growth in human population. With this increase in human numbers, there's growing demand for resources. Agricultural production is going to have to increase by 50% by 2050. This means agricultural intensification to produce more crop from the same area. But a lot of our wildlife live in these agricultural landscapes, so what would be the cost for biodiversity?

A study of agricultural intensification showed that forest-dependent species are sensitive to intensification and decline quickly as intensification increases. On the other hand, species that regularly occur in croplands survive for quite a while but still drop off with very high intensification.

Comparisons between the potential for agricultural intensification and the potential for biodiversity loss show that, where there's substantial incentive to intensify, there are also big consequences for biodiversity. Across the world, if all the available cropland is intensified, there would be a 37% loss of biodiversity.

There's a real imperative to understand how our species are using agricultural landscapes, so we can know what the risks are and can figure out ways to solve it.

Frogs in agricultural landscapes

Case study 1: Nicole Hansen looked at habitat use and movement in dry cropping farmland in NSW. She compared cropped areas, recently planted areas, pasture, and paddocks with eucalypt mulch, and surveyed before and after the crop harvesting. The frogs didn't respond very much to the experimental design. They were pretty robust to what was going on in these landscapes. There was a high total abundance of frogs at the edge of remnant vegetation and in the farmland, and there was evidence that frogs accumulate or use plantings in this dry farming landscape. However, the species included in this study are robust; another twelve local species weren't trapped in this study and it's possible that many species that have already gone from the landscape.

Some individual species showed responses to the way we manage our landscape. Smooth toadlets *(Uperoleia laevigata*) had higher body condition and higher abundance at the edge of the fine woody debris treatment. The reason forthis is not clear. Smooth toadlet also seemed to be doing better in recently harvested areas than before the harvest or in the other areas.

Case study 2: Stephanie Pulsford's study area had higher rainfall, smaller paddocks and more trees in the landscape, and was grazed and not cropped. She compared pastures, coarse woody debris (where she actually added firewood to the landscape), fences , and plantings.

She found more uncommon frog species in remnant vegetation when it has longer grass (when it hasn't been grazed a lot). Grazed remnant vegetation has similar numbers of uncommon species to the numbers in paddocks. But longer grass in paddocks doesn't have the same benefit for the uncommon species.

The total abundance of frogs was negatively related to distance to water. So farm dams are good for these common frogs. But abundance close to dams was slightly higher in the remnants. Frogs breed in farm dams, then they head off across the landscape. Possibly, frogs remain in remnant vegetation whereas frogs crossing paddocks just keep going.

Case Study 3: Sam Wallace looked at the impact of cropping in swamps on frogs in south-west Victoria where there are lots of small swamps and many frogs. In this area, there is pressure to increase agricultural production. Sam surveyed ninety-four swamps, some in

good condition with a bunch of native vegetation still in them, others that were cropped. Five frog species were common enough for to analyse individually.

Calling season varied between species, but detection of frogs was not affected by temperature, cloud cover or relative humidity. Wind speed and rain affected some species.

In this landscape, there are so many swamps at roughly regular intervals that there wasn't much effect of the distance to the nearest swamp or refuge.

Brown tree frogs were less likely to survive where swamps are heavily cropped. Pobblebonks were more abundant around swamps with more refuges where they could burrow and survive during the non-breeding season. Pobblebonks and spotted marsh frogs are more likely to occur when you've got high grass and rush cover, low herb cover and low amounts of bare ground.

These results are based on the species that are still present. Species more sensitive to the changed conditions may already have been eliminated.

Conclusions

Key lessons from studies about how frogs use landscape elements are: Linear plantings are potentially quite important in dry country. Frogs frequently use the paddocks and some species are better off in the paddocks. Frog seem to accumulate along linear features, particularly along plantings. Importantly, remnant condition, and vegetation structure and proximity to water are important. And we think that there's a bunch of habitat specialists that might already be gone from these landscapes.

Most importantly, agricultural intensification causes frog declines. There is an imperative to understand how our wildlife use farming landscapes so that we can put measures in place to ensure they continue to survive as farming practices change towards more intensive production methods.