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Unconventional shale gas and oil: overview of ecological impacts

Research findings on the wildlife and habitat impacts of unconventional shale gas and oil developments in the US have been collated in a new review. Its authors stress the importance of collecting data on local ecosystems before such developments begin, to allow changes in nature be tracked and aid on-going improvements to management.

Unconventional shale oil and gas are already important sources of energy in the US, and other countries around the world are investigating the possibilities of exploiting their own reserves. New horizontal drilling methods mean that large areas of previously uneconomic oil and gas reserves may now be viable. On the basis of the precautionary principle, this means that it is more important than ever to assess the exact ecological impacts of such developments.

Impacts can occur at every stage of a development's process, from initial exploration and seismic testing, to well drilling, hydraulic fracturing and finally, production, transport and storage of the gas and oil. For this study, researchers reviewed a wide a range of scientific studies on the impacts on wildlife and habitats of each stage of development. They divided the main effects on ecosystems into five categories: habitat loss and fragmentation, effects on both water quantity and quality, human disturbance and noise pollution.

The average unconventional well pad is 1.2–2.7 hectares in size, and the construction of pipelines, roads and other infrastructure has been estimated to lead to an additional habitat loss of 2.9–3.6 hectares per pad. Fragmentation is likely to be an even greater threat than habitat loss in this case, research shows: roads, pipelines and pads restrict wildlife movements, help invasive species to spread and affect habitat characteristics, such as isolation, moisture and temperature.

As well as land, unconventional gas and oil extraction requires large amounts of water. On average, hydraulic fracturing needs 11-30 million litres per well and multiple wells on a single pad can put greater pressure on water supplies, with possible severe effects on aquatic wildlife in the local area.

Aquatic ecosystems near unconventional developments may also be at risk from water pollution. Wastewaters from the wells can contain various contaminants, including salts, toxic metals, naturally occurring radioactive materials, as well as additives used in the fracking process. Wastewater treatment must be able to deal with such pollutants. Studies in the US have found elevated levels of salinity, chlorine and radioactive elements downstream of certain water treatment plants for unconventional shale and gas developments.

Efforts must also be made to reduce spillages of all kinds—including fluids used for fracturing, 'flowback' waters when water used in fracturing returns to the surface, 'produced' waters from the production phase of the well and 'drill cuttings' (small solid particles carried to the surface by wastewaters). Such accidents do appear to be rare, the authors conclude, but non-disclosure agreements between land owners and energy companies may mean that they are under-reported.

Disturbance as a result of the presence of humans and noise pollution can also both have substantial negative effects on wildlife. For example, traffic to and from developments can kill animals directly or change their behaviour. It is estimated that the development of one horizontal well requires over 3300 one-way truck trips. Noise pollution from, for example, compressors along pipelines, can also reduce habitat quality. Research has shown that the presence of compressor stations can reduce songbirds' abundance and breeding success.

One of the most important points arising from this review, the authors conclude, is the crucial need for baseline data. Collected before development begins, baseline data allow changes to be tracked and aid adaptive management.

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