# Sensor technology in sheep on range pastures to monitor health and welfare

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Loss of sheep on range and mountain pastures is a serious animal welfare problem. In Norway, more than two million sheep graze on unimproved, rough grazing lands during the summer months each year. These free ranging flocks benefit from behavioral freedom with potentially positive impacts on animal welfare. Predator attacks, undetected diseases and accidents compromise these benefits. About 125 000 sheep (6-7%) are lost on such pastures every year, and single flocks may experience loosing half their flock. To improve animal welfare, sustainability and profitability in sheep farming in Norway, sheep losses must be significantly reduced. Implanted sensors can monitor physiological parameters, such as body temperature and heart rate. Real time notification of physiological irregularities to the farmer would enable immediate treatment or other intervention. Integrating such sensors in existing GPS tracking systems could help to detect, locate and treat sick animals. Regarding predator attacks, the system could notify chasing followed by the sudden death of an animal, which in turn would enable target oriented guarding or the prompt evacuation of remaining livestock. Use of technical innovation could be an important tool to reduce the loss of sheep and improve animal welfare on range and mountain pastures. In this study, we test if sensors that measure body temperature and heart rate can detect disease and behavior traits (i.e. predator attack).

Temperature and heartrate sensors (Star Oddi, Iceland) are implanted in 20 lambs in a sheep flock in a tick-borne fever risk area and in 20 lambs and their 10 mothers in a predatory risk area. The telemetry system (Telespor, Norway) provides accelerometer information and real-time positioning data. All animals are closely monitored and an experimental predator test is being performed two times in each of the two flocks.

The project's goal is to test sensors that measure body temperature and heart rate and to assess the sensors' precision and suitability as a monitoring and warning tool for diseases and predator attacks in sheep farming. This is the first step towards developing a monitoring system that enables the early detection of diseases and predator attacks at the individual animal level, also for free-range livestock farming.