

A Research Overview of the Effects of Confined Animal Feeding Operations on Aquatic Ecosystems

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Confined animal feeding operations are a rapidly growing sector of the United States agricultural economy. The U.S. Geological Survey (USGS) is actively involved in research efforts to assess the effects of Animal Feeding Operations (AFOs) on aquatic ecosystems and on the chemical quality of ground-water and surface-water resources. The purpose of this presentation is to provide an overview of USGS research and monitoring activities related to AFOs. In addition, some USGS capabilities for studying the effects of AFOs on aquatic biota and the effects of aquaculture on the environment will be examined.

USGS scientists are applying diverse and interdisciplinary approaches to ecosystem research, in particular with respect to understanding contaminant transport and assimilation processes. Questions being addressed through research and on-site monitoring involve the occurrence and magnitude of nutrients, pharmaceuticals, and pathogens that could be entering streams and ground-water systems and that originate from concentrated sources of animal feed and waste products. The results of these studies are germane to public concerns that industrial-scale livestock, dairy, swine, poultry, and aquaculture operations could have acute, long-term, and cumulative effects on riparian, surface-water and ground-water resources.

A summary of some of the major categories of USGS research and investigations related to concentrated animal feeding operations follows:

PHARMACEUTICALS (antibiotics and endocrine disruptors): Reconnaissance sampling of 100 streams across the United States is underway to provide baseline data on the occurrence of antibiotics in streams. Occurrences of antibiotics will be compared with predominant animal types for respective watersheds.

PATHOGENS (viruses, bacteria, and protozoa): Streams and ground water adjacent to high-density animal production facilities are being sampled for pathogens in five States.

NUTRIENTS (nitrates, ammonia, phosphorus): Monitoring the water quality of springs in a region of northern Arkansas populated with poultry AFOs is ongoing to determine the nonpoint source of nutrient contamination.

METALS, TRACE ELEMENTS, AND PESTICIDES: The fate and transport of these contaminants in runoff from dairy operations in California is being investigated.

TECHNOLOGY AND METHODS DEVELOPMENT: Analytical methods to detect low concentrations of some of the most prevalent classes of pharmaceutical compounds are being developed and validated. DNA testing is being conducted to determine the source (poultry or cattle) of fecal-coliform contamination in Missouri streams. RNA ribotyping techniques are being developed and applied to track the source of microorganisms in Virginia streams and ground water near AFOs. Age dating and nitrogen isotope ratio analyses are being applied to ground-water samples in Colorado to determine the origin of elevated nitrate and ammonia. Computer models, such as SPARROW, are being developed and adapted to assist water-resource managers in their decision making

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