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Examples of general areas of current and proposed research.

- Development of environmentally sustainable methods for management of agroecosystems. Current research concerns sustainable management of destructive pests and invasive species, using methods designed to reduce long-term impacts on native, semi-native, or agricultural ecosystems. Research on ecotoxicology and ecological dynamics is intended to anticipate and solve problems in advance, in order to promote the well-being of protected landscapes, biodiversity and species at risk. Example study: the disease dynamics and environmental safety (terrestrial and aquatic) of entomopathogens proposed for control of grasshoppers and other grassland insects.

- Ecology of selected grassland animals, plants and microbes, including characterization of food webs, biodiversity, and phenology. The results assist in modeling ecosystem resilience, and predicting responses to challenges and disturbance (e.g., toxins, extreme weather, fire, vegetation management). Example study: the role of grazing management, vegetation modification and fire in the dynamics of insect populations of shortgrass and fescue foothills rangeland, with reference to insects as a food resource for grassland birds such the Burrowing Owl.

- Effects of climate variability (past, present and future) on organisms in semi-arid ecosystems. Research includes consideration of the role of natural and modified landscape, and linkages of semi-arid terrestrial and aquatic ecosystems. Example study: effects of weather on the dynamics of insect cycles.

Research sites include western Canadian semi-arid ecosystems, mainly dry mixed grass and fescue foothills in Alberta, British Columbia and Saskatchewan. Some experiments and research topics (such as entomopathology, epizootiology, grassland food web ecology, arthropod-vertebrate interactions, and decomposition ecology) are closely linked to ecological research in other semi-arid zones, including in the U.S. and Australia, with applications in Africa and China. The program utilizes mainly field experimentation, sampling, ecological methods, laboratory analysis and process modeling, but depends on collaborative support in remote sensing, spatial analysis and analytical chemistry.

## Examples of current collaborative research projects

1. Assessment of the expected impacts of climate and environmental scenarios on biodiversity and ecological integrity of semi-arid systems, and on changes in the distribution, abundance and activities of key organisms.

Current research funded by the Climate Change Action Fund concerns changes in abundance, diversity and activity of grasshoppers. The results will lead to development of management plans and actions designed to reduce economic and environmental losses. Methods and models developed during this study will be applied to manage future invasions and outbreaks, and to prevent local extinctions of beneficial species or assemblages of species. Organisms of interest include certain arthropods, plants, vertebrates, and microbes, including decomposers and pathogens).

2. Characterization of past and future impacts of climate and geography on selected aspects of biodiversity, endemism, metapopulation ecology, and ecosystem processes of alpine, montane and fescue foothills ecosystems (Alberta and eastern B.C.), with linkages to lower elevation grassland ecosystems.

Results will provide new knowledge needed to understand the structure and operation of populations and ecosystems, identify genetic, species and geographic variation relevant to management, and provide baseline data on indicator species. Current research subjects include mainly insects (terrestrial and aquatic) and arachnids.

3. Experimental characterization and modeling of food web relationships of semi-arid ecosystems and agroecosystems, including grazing, predation and decomposition aided by detritivores.

Results will be used to characterize ecological linkages and predict impacts of challenges in semi-arid ecosystems, and to compare proposed management practices.

4. Assessment of grassland management and restoration practices (e.g., toxins, extreme weather, fire, range management, vegetation change) on the availability and quality of insects as food for grassland species at risk, and other wildlife species.

Results will provide hard data and models on nutritive quality of the diet available to grassland animals, and methods of assessing habitat quality.

5. Ecology, biodiversity, taxonomic status, and economic status of selected pest and non-pest arthropods of the Canadian Prairies and Northern Great Plains

Results will provide scientific knowledge as well as educational material (public, academic, and K-12) currently poorly known, on major groups of grassland species.

6. Development of non-chemical methods of control of devastating pests (such as grasshoppers), to support organic and low-impact agriculture in the semi-arid zone, and to offer alternatives for

the protection of sensitive habitat from pesticide contamination.

Results will be provided to manufacturers and regulators, to reduce chemical pesticide use where landowners and producers would like a non-chemical option.

7. Improved environmental safety and ecotoxicology of existing and proposed management, practices and products applied to semi-arid systems on the Canadian Prairies and Northern Great Plains.

This study will include experimentation and monitoring to determine the probable impact of present and proposed development and management of grassland, such as the use of genetically modified crops, changes in vegetation and grazing management, and application of new chemical tools. Results will provide a rational basis for comparing the impacts of proposed management actions, and mitigation of naturally occurring challenges, and improving the resilience and productivity of grassland ecosystem.

Recent publications and courses are listed at:

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